

School Construction Technology Checklist

Office of Knowledge information Data Systems (KIDS)
Technical Guide

Version 2.0

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School Construction Technology Checklist Guide

This document is intended as a foundation to be used by local school district Chief Information Officers (CIOs), other district staff involved in facilities (building and district level administrators) and KETS Partners to guide discussions related to new construction as well as renovation of existing facilities. While you will find many of the areas of technology related to the Kentucky Education Technology System (KETS) within the following pages, this document is dynamic and will continue to be updated as facility needs warrant and new standards are released.

Within each section you will find a general document, typically one to two pages, that gives a brief overview of that particular piece of technology. For example, the “Fixed Interactive Whiteboard Systems” section gives a brief overview of the types of whiteboard systems, specifications that should be considered and links to any related standards documents that should be considered and incorporated into any decision making process. In this example, as Intelligent Classroom implementations continue to evolve requirements within the Technology Checklist document will be updated to reflect similar changes.

Where applicable, references to available KETS or other contract sources have been made. In regards to technology where current KETS contracts already exist, it is required under statutory mandate that the technology being purchased come from the appropriate KETS contract.

Funding Sources

Districts should look to various funding sources as appropriate to support technology implementations within their district. For each type of technology listed within this document you will find a listing of applicable funding sources which includes: KETS (S/L), Local (L) and Facilities (F). Each type of funding source should only be used where appropriate and available.

Your KETS Customer Relationship Manager (CRM / KETS Engineer) can assist with questions concerning the appropriate use KETS and Local funds. The guidelines for use of Facilities (Construction) funds are that the technology item must be fixed equipment and part of the building. For questions and final approval on use of Facilities (Construction) funds you should contact the District Facilities Branch in the Division of District Support (502) 564-4326.

Intelligent Classroom

Students and teachers in Kentucky would like access to many technology tools available for today’s classrooms. These tools include two-way video desktop conferencing, electronic projection and whiteboards, interactive student voting for formative testing, wireless, phone conversations over Internet, Instant Messaging (IM), speech recognition, large-scale e-books, electronic paper and grid computing. Using these technology tools while being managed by technology-knowledgeable teachers, students can develop the ability to take charge of their own learning and can perform work at their own paces through differentiated learning. Ultimately, technology can allow children to develop at their own paces, learn in a way that is most beneficial for each student and meet the goals of the state’s curriculum requirements.

This type of advanced learning necessitates teachers who bring a fresh perspective to instruction and are supported in their use of educational technology. Schools and classrooms, both real and virtual, must have teachers who are equipped with technology skills, have direction from a number of professional development resources and who are, as a result, motivated and excited by educational technology. By utilizing the previously mentioned tools, teachers can effectively teach the necessary subject matter content while incorporating technology concepts and skills. Educational technology should provide students with real world

experience by exposing them to independent source material, critical problem-solving analysis and unprecedented collaborative tools.

Kentucky understands the importance of providing every student with a classroom environment that emphasizes modern technology in every classroom, a connection to the information superhighway and diverse online resources. By making this vision a reality, students will achieve proficiency and be prepared to continue on to and succeed at higher education, business, the military or any other endeavor they choose to pursue.

It is the goal within the state of Kentucky to provide a supportive instructional environment where students utilize the latest and most advanced learning methods. In order to achieve this supportive instructional environment, schools must integrate technology across the curriculum to transform traditional classrooms into dynamic learning environments.

Using these technology tools, and being managed within the classroom by technology-knowledgeable teachers, students can develop the ability to take charge of their own learning and can perform work at their own pace through differentiated learning. Ultimately, technology can allow children to develop at their own pace, learn in a way that is most beneficial for each student, and meet the goals of the state's curriculum requirements.

Product Standards

Our approach is an enterprise design in which all districts are working toward common objectives. When all districts use product standards, all of the state's school districts maximize the taxpayer dollars by ensuring the highest possible levels of interoperability and a consistent look on any workstation across the state. Standards also minimize the retraining required when staff move between schools or districts and lessen the annual support required after implementation. The purchasing power of the state is maximized by leveraging the weight of the entire organization to buy a product standard. The Gartner Group noted that Kentucky was saving millions with the architectural standards approach.

Components for Which Standards already exist or are being established:

- Student, teacher and administrator [workstations](#)
- Instructional and administrative printers
- Instructional and administrative file servers
- Network components: routers, network concentrators, network interface units, network interface cards, network computing services, CSU/DSUs, network switches, Telco data lines, Telco voice lines
- Building wiring (incorporates EIA/TIA standards): work area wiring, horizontal wiring subsystem, building backbone subsystem, campus backbone subsystem, power wiring, installation standards
- Remote communications: VPN
- Software: network operating systems, operating systems, relational database systems, office products (word processing, spreadsheet, calendar, graphics, end-user database), electronic mail, Internet browser, remote access software, proxy software, network management software, desktop management software
- Instructional software: KETS does not establish specific standards for instructional software. KETS has developed guidelines in the form of a checklist for educators to use during software selection. Instructional software must run, however, on KETS-standard hardware in a KETS-standard network environment. To secure discounted pricing, KETS does issue competitive solicitations and establish price contracts for the most popular instructional software products.
- Applications: District financial management and Administrative management, School student management, District-level accumulator, online instructional software review service
- Television monitors
- Help Desk services
- Maintenance services
- Multimedia applications and services: projectors, whiteboards
- Distance learning: Kentucky Virtual High School (KVHS), Kentucky Telelinking Network (KTLN), Kentucky Virtual Library (KVL), Kentucky Education Television (KET), Kentucky Virtual University (KVU)
- Proficiency training
- Assistive and adaptive technology
- Enterprise database
- Instructional and administrative technology integration leadership
- STLP

- Telephone systems

Technology Standards

Technology Standards represent a uniform set of specifications and guidelines which are leveraged to insure system interoperability and reduce operational complexity, therefore reducing the overall Total Cost of Ownership.

“The Commonwealth is committed to the guiding principle of viewing technology investments from an enterprise perspective. The Enterprise Architecture and subsequent standards represent the overall plan and a living process for designing and implementing information technology solutions to serve both instructional and business functions.

An information technology architecture and related set of standards are vital to ensure the compatibility of the current IT projects and other future IT initiatives. The Enterprise Standards are important for defining the rules by which technology is envisioned, implemented, and managed.”

Since 1992, Enterprise Standards have anchored all instructional, administrative, and technical aspects of Education Technology. These standards have afforded the Commonwealth a) significant savings in the initial procurement of technology equipment, b) equitable supportability regardless of geographic location, c) a foundational infrastructure to provide for secure, global ease of access, d) statewide collaboration via various forms of electronic mediums (email, telephonic, video-conferencing), e) statewide adoption of the Internet as an instructional resource, and f) uniform business applications to address both student management and financial management. All Commonwealth of Kentucky Public School districts share in the benefit of each of these efficiencies due to a common set of technology standards.

Standards Community

A standards organization, also referred to as standards development organization or SDO, is any entity whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise maintaining standards that address the interests of a wide base of users outside the standards development organization.

KETS Standards are derived and/or subsequently adopted with either input from, or as a directive of a variety of these entities:

- **Industry Standards Organizations** such as ANSI, IEEE, IETF, SANS, ISC2.
- **Legislative Organizations** such as the Kentucky General Assembly, and the Kentucky Board of Education.
- **Educational Organizations** such as ISTE, SREB, CCSO, and NECC.
- **State Organizations** such as the Commonwealth Office of Technology (COT), and Kentucky Department of Education (KDE).
- **Research Organizations** such as Gartner.
- **Product Development Organizations** such as Microsoft, Dell, Nortel, and various vendor consortiums such as SIF.

Enterprise Architecture, Policy, Products, and Standards

Enterprise Architecture and Standards covers the broad spectrum of technology environments to include software, hardware, networks, applications, data, security, access, communications, project management and other relevant architecture disciplines. These technology areas are described in domains, and each domain contains enterprise policies, standards, and products to support the vision. Additionally, specific technology components (hardware or software) which have been deemed by either the Kentucky Department of Education or Commonwealth Office of Technology as an enterprise component and subsequently made available via a Statewide Procurement vehicle (State or KETS Contract) are considered KETS and/or State Product Standards.

These product standards are listed within the respective Enterprise Standards Domains:

Enterprise Standard Domains

Infrastructure

- Network
LAN, WAN, Wireless, Protocols, Components, Computing Services, Switches/Hubs, Modems, Installation Standards

Security Systems

Information Security Management, Architecture and Models, Access Control Systems and Methodology, Applications and Systems Development, Operations Security, Cryptography, Physical Security, Telecommunications, network and Internet Security, Business Continuity Planning, Law, Investigation and Ethics

Hardware

Desktop Computers (PC, MAC), Servers, Printers, Tablets, Fileservers

Software

Operating Systems, Office Suite, Database Management Systems, Email, Proxy, Internet Browser, Remote Access, Anti Virus, Multimedia

Data - common data elements, data definitions, naming conventions, geographic information system (GIS) data standards

Administration

Management

Metadata

Operations Environment

1. Support Management
 - o Helpdesk
2. Operations Management
 - o Performance Monitoring, Backup, etc.
3. Web Management
4. Systems Management
 - o Tools for management and control of servers, networks and IT infrastructure
 - o Communications
5. Internet
6. Telephony

- Email, Voicemail, Interactive Voice Response (IVR)
 - **Project Management** - Discipline of defining and achieving targets while allocating use of resources (time, money, people, materials, energy, space, etc.) over the course of a project.
7. Tools and Method

All KETS and State Enterprise Architecture, Policies, Products, and Standards can be located at the following URLs:

KETS Standards -

<http://www.education.ky.gov/KDE/Administrative+Resources/Technology/Technology+Architectural+Policies+and+Standards/default.htm>

State Standards - <http://cot.ky.gov/policies/>

Architectural Standards Committee

The KETS Architectural Standards Committee (KASC) has been formed to participate in the overall governance aspects of Architectural Standards adoption and/or modification. This committee is comprised of both local school district and KDE representatives, and is chartered to provide guidance, input, and recommendations into the overall process of standards adoption.

The KASC meets on a monthly basis and submits its recommendations to the Office of Knowledge information Data Systems. Once the request is accepted members at times where appropriate may work very closely on various action teams to provide the content for the recommended standards that will be generated.

For more information visit:

<http://www.education.ky.gov/KDE/Administrative+Resources/Technology/Technology+Architectural+Policies+and+Standards/Architectural+Standards+Committee.htm>

Unmet Need Standards and Policies

Unmet Need Standards represent the equitable baseline of all technology components required to adequately address both the instructional and administrative needs of K12. These standards are derived from two separate but complimentary criteria:

- **Component Ratios (Quantities)** – Baseline minimum ratios for each technology component have been established based on average daily attendance, total number of schools, total number of teachers, or total number of classrooms. It is the expectation that all districts maintain these minimum ratios to effectively address equitable ease of access for all instructional and administrative activities.
- **Component Standards (Products)** – All published architectural standards and associated products are considered KETS Standard Components.

Any technology procured or secured by a district, in a category for which a Kentucky Education Technology System unmet need standard is established, regardless of whether the item is used to reduce the unmet need or not, must meet or exceed the KETS standard in compliance with 701 KAR 5:110.

Any technology procured or secured by a district, in a category for which a Kentucky Education Technology System unmet need standard is established, regardless of whether the item is used to reduce the unmet need or not, must be included in the District Technology Plan as inventory.

Technology secured through local initiative which is not procured with public revenues will not be used to reduce the unmet need of the district for the purpose of calculating the amount of offers of assistance for which the district is eligible.

Technology procured with federal categorical funds will not be used to reduce the unmet need of the district for the purpose of calculating the amount of offers of assistance for which the district is eligible.

Statutory Authority and Responsibility

The Master Plan for Education Technology

Standards

KRS 156.160(1) stipulates that the Kentucky Board of Education has a statutory mandate to prescribe standards, which school districts shall meet. Among these are standards for the "acquisition and use of educational equipment for the schools as recommended by the Council for Education Technology" (KRS 156.160(1)(b)).

The statutes do not restrict the standards-setting responsibilities noted above to any particular source of funds. The Kentucky Board of Education, therefore, has the authority and obligation to specify standards for education technology to which school district acquisitions of hardware and software are subject regardless of source of funds. The board may specify, as it deems necessary, a standard for any line item in the Master Plan budget.

These standards are set forth in the Master Plan for Education Technology and incorporated by reference into Kentucky Administrative Regulations (KARs) pursuant to 701 KAR 5:110 and in compliance with KRS 156.160(1).

Districts are required by 701 KAR 5:110 to procure only those technologies that meet KETS standards, if a standard for that category has been established, regardless of source of funds.

Education Technology Trust Fund

The Education Technology Trust Fund is established in the Finance and Administration Cabinet by KRS 157.665(1) to provide education technology for the public school system.

Funds are appropriated to the trust fund in each biennial budget. All interest earned on money in the fund is retained for reinvestment in the fund. All money credited to the fund, including interest, is to be used for education technology as defined by the Kentucky Board of Education's Master Plan and does not lapse (KRS 157.665(2)).

The School Facilities Construction Commission, within the Finance and Administration Cabinet, is responsible for distributing state funds to local districts through the education technology-funding program (KRS 157.650).

To participate in the education technology funding program, a local public school district must have an unmet technology need described in the district plan and approved by the Kentucky Board of Education (KRS 157.655(1)).

The base level of assistance to each district is determined by dividing the total amount available in the trust fund by the total of the prior year's average daily attendance of the eligible districts times the individual district's prior year's average daily attendance (KRS 157.660(1)).

Funds transferred to districts are to be used only for the projects included in the district's plan (KRS 157.660(2)).

Trust funds are transferred to local districts after the district's need for assistance has been certified by the School Facilities Construction Commission. All other expenditures from the fund require the approval of the Kentucky Board of Education (KRS 157.655(3)).

Calculation of Unmet Need

Any technology procured or secured by a district, in a category for which a KETS unmet need standard is established, regardless of whether the item is used to reduce the unmet need or not, must meet or exceed the KETS standard in compliance with 701 KAR 5:110.

Any technology procured or secured by a district, in a category for which a KETS unmet need standard is established, regardless of whether the item is used to reduce the unmet need or not, must be included in the District Plan as inventory.

Approval of the unmet need amounts for local school districts is the first step required to allow local school districts to receive state funding to assist them in funding hardware, software, personnel, professional development and other technology initiatives that will support students in achieving academic excellence and reaching proficiency by 2014.

Staff certify that the districts recommended by the Commissioner of Education have met all the statutory requirements of KRS 157.655 and KRS 157.660 and will be required to adequately describe their unmet need and current KETS inventory before Offers of Assistance are distributed.

The following must occur before a district receives its funding:

1. Kentucky Board of Education approves unmet need for districts.
2. School Facilities Construction Commission (SFCC) approves unmet need.
3. The district successfully meets all of the statutory requirements of KRS 157.655 and KRS 157.660.
4. The district verifies its final ADA count to KDE's Division of School Finance.
5. KETS staff calculates Offers of Assistance based on these variables.

The districts must follow requirements of the SFCC by receiving approved board action and proof of deposit of funds into a local interest bearing technology account. The SFCC will then wire funds to the district's technology account.

There are four categories of unmet need: operations; maintenance; incremental replacement; and new technologies.

Expenditures in **operations and maintenance** are absolutely necessary to sustain current levels of service. If unmet need within the operations and maintenance categories is not addressed in accordance with program guidelines, the integrity, sufficiency and capacity of the district technology infrastructure will degrade until services are seriously curtailed or eliminated. These include items such as student workstation repair, teacher workstation repair, instructional software improvements, classroom printer repair, instructional fileserver repair, school management software improvements, initial/ongoing technology integration, professional development, student technology leadership services, Internet services, telephone communications to parents, distance learning service, help desk services, e-mail services, enterprise data system access and school financial management services.

The unmet need for **incremental replacement** constitutes a framework for replacement of various technology components on a scheduled basis over time, in accordance with the life cycle of each item or service. These include items such as student workstations, teacher workstations, instructional fileservers, assistive and adaptive technology, school laser printers, classroom color printers, wireless networks, student hand-held devices, high-speed fiber networks, desktop conferencing and digital projection devices.

The unmet need for **new technologies** includes products and services that are more discretionary in nature, products and services that are today only marginally available or affordable and products and services that are perceived as needs in the planning horizon.

The Kentucky Board of Education will acknowledge and approve the unmet need for each district. In the KETS Implementation Plan, the board also will be considering approval of the amount of funds available to go toward that unmet need. Districts must continue to secure alternative funding sources beyond the KETS funds, using federal funds, local grants or other sources, to fully fund the unmet need. Budgeting skills will be required to sustain and implement Phase III of KETS.

Table of Contents

All Infrastructure included from Building and Wiring (B/W) Checklist	
B/W Checklist Summary	14
B/W Checklist Form	15
Note: Print form pages only (pages 15-20). You do not need to print entire document.	
Capacity Planning	
o Physical space for future capacity/expansion	
Classroom	
Fixed Interactive Whiteboard Systems	21
o Audio Visual Equipment	
Projectors (i.e. fixed, ceiling mount)	22
Workstations	24
Servers	29
Facilities Management	
o HVAC	
▪ Dedicated air system for server rooms (independent system-off loop) (also consider backup generators) or demark locations	
▪ Data Center HVAC Systems ¹	
o Plumbing	
▪ Dry fire suppression in main data centers	
Voice	
o All Telephone Systems (except handhelds)	
o Existing PA Systems (Intercom) ²	
Video	
o Distribution Systems	
o Conferencing Equipment	
o Security - Surveillance Equipment	
Wiring	
o Data	
All Data, Voice, Video Wiring and Substructure	33
– Cable Trays	
– Conduit	
– Both Termination Points	
– Fiber and all associated terminations and transceivers	
– Lunch Box Card Reader	
– Video Security	
o Electrical	
▪ Campus Wide Lighting Control	
▪ Marquee Sign	
o Data Facilities	
▪ Wiring Closets (MDF and/or IDF)	
– Racks	
– Distribution/Patch Panels	
– Fixed Cabinets	

¹ This includes modifications of systems in existing building (duct work and/or separate zoning)

² Older systems that are updated/modified and not covered by telephone intercom systems

- De-Humidifiers
 - Static Suppression
 - Water sensors
 - Network Switches
- UPS
 - Rack Mounted
 - Data Center Free Standing
 - Surge Suppression
 - Back up Generator
-

Appendices

KETS Standards

Interactive White Board Standard	36
Projectors	38
Wireless Local area networks (WLAN)	49
VPN Remote Access to the KETS Network	53
Video Phone Standard	55
Building and Wiring Explanation	56
Server Technical Standards	67

Building and Wiring Checklist Summary

Connectivity Considerations in Today's Instructional Environment

The 21st Century School and Classroom continues to evolve from an environment we have all been familiar with. As instructional technologies tools continue to evolve in variation and user access, school districts are beginning to recognize that the “one size fits all” implementation of the past may not be applicable anymore.

Historically the KETS standard for wiring implementation has focused on a “hard wired” (network jacks in the wall connected by Ethernet cable to the network) approach which required an identified number of hard wired wall jacks to accommodate student computers, teacher computers, voice (telephone) handsets and video (coax). While this approach has been instrumental for ensuring all schools and classrooms (existing, new or renovated) had equitable access to the internet, email and other network resources, the evolution of technology today is conducive to flexibility where appropriate to enhance the instructional opportunities for students.

Over the past 2 to 5 years end user instructional devices have transformed from the traditional desktop or laptop computer into devices with much greater mobility (i.e. netbooks, slates, tablets, small handheld computing devices, smartphones) that are more likely to leverage wireless (802.11) networks than a traditional hard wired network. As of 2011 (http://applications.education.ky.gov/trs_reports/) there are over 10,000 district owned handheld computer systems (i.e. netbooks, slates, smartphones, etc.) which when coupled with 55,000+ personally owned devices being reported by districts that are allowed to be brought to school, is forcing school districts to plan on how to provide appropriate network access for the continued growth of mobile user devices. As school districts move to take advantage of the proliferation of wireless connected devices to enhance instructional opportunities for students and staff, decision makers for construction and renovation projects will want to consider whether a hard wired or a wireless access approach is best suited for their particular instructional needs.

When submitting the Building Wiring Checklist, school districts will want to have conversations with stakeholders including but not limited to district administration, teachers, students, district/state technology leaders and building level administration to determine whether a traditional hard wired approach or wireless approach is more appropriate for your district's instructional needs. Districts should keep in mind that even though implementing a “building wide” wireless approach may reduce the number of hard wired jacks from what has been required, there are still technologies that for the foreseeable future need to be provided for, through traditional hard wired connections. Below you will find a list that while not all inclusive of every technology you may deploy as part of your new construction or renovation project, does take into account the minimum KETS requirements as well as what would be expected to be found in today's 21st Century Classroom.

- Student instructional device (hard wired and/or wireless)
- Staff instructional device (hard wired and/or wireless)
- Voice – telephone whether traditional or VoIP (hard wired)
- Video (hard wired) *please see Building Wiring Checklist for more information on Coax versus Video over IP
- Projection device – LCD projector or large screen TV (hard wired)

- Printing capabilities (hard wired)
- Wireless Access Points (hard wired)¹
- Additional hard wired ports for future technology needs (i.e. network aware instructional devices)

¹ Please refer to the wireless access point standards document found within the [School Technology Construction Checklist](#) document.

It is essential that as part of any new construction or renovation work the district instructional administration, CIO/DTC, architectural firm and design contractor/engineer work together to ensure the instructional needs of students and staff as well as the district instructional vision are being met by the work proposed within the submitted Building and Wiring Checklist. This requires all stakeholders to be involved in discussions and decisions throughout the entire construction process.

For further guidance on the Building and Wiring Checklist and working toward meeting the instructional technology needs of today's students and staff you are encouraged to also engage the KETS Engineer/Customer Relationship Manager for your district. Contact information for each can be found on KDE's website in the [Customer Service](#) (<http://bit.ly/kwNGRV>) section.

Related Documents:

- [Building and Wiring Explanation](#)

BUILDING and WIRING DESIGN CHECKLIST Version 3.2 2011

Date Requesting: _____

School Name: _____

District Name: _____

Check One Below

- | | | |
|---|--------------------------------------|--|
| <input type="checkbox"/> New Construction | <input type="checkbox"/> Renovation | <input type="checkbox"/> Additional Building |
| <input type="checkbox"/> Additional Wiring (Existing LAN) | <input type="checkbox"/> Replacement | <input type="checkbox"/> Update |

School Size (ADA) _____

Number of Classrooms _____

Number of Student Data Drops (Classroom):

- | | |
|--|-----------------------------|
| <input type="checkbox"/> Traditional Ethernet (6 per Classroom) | Total Number of Drops _____ |
| <input type="checkbox"/> Wireless Access Point(s) (26 or Fewer Connections per WAP Device) | Total Number of WAPs _____ |

Total Number of Teacher Drops: Voice _____ Data _____

Facility/Classroom Resource Drops:

- ☐ WAPs (See Student Drops) Location/Number of Drops:
- | | | |
|--|--|--------------------------------------|
| <input type="checkbox"/> Classroom _____ | <input type="checkbox"/> Hallway _____ | <input type="checkbox"/> Other _____ |
|--|--|--------------------------------------|
- ☐ VIDEO ☐ Traditional Cable (R6/R11) _____ ☐ Ethernet (CAT 6 or Greater) _____
- ☐ Projector _____
- ☐ Printer(s) _____
- ☐ Smart Board/Other _____

Facility/Administrative/Offices/Data Center/Residential Drops:

- ☐ Offices/Other ☐ Traditional Ethernet CAT6 or Greater _____ ☐ WAP(s) _____
- ☐ Data Center _____ (Ethernet CAT6 or Greater)

Number of Wiring Closets CDF _____ MDF _____ IDF _____

Funding Resource:Using LOCAL FUNDS Only? ☐ YES ☐ NO Amount of EDTECH FUNDS Requested \$ _____

List each item with description and amount. (Use separate sheet if needed or Excel worksheet)

Does this Design Reduce Unmet Need? ☐ YES ☐ NOIs KETS contact(s) being utilized for procurement? ☐ YES ☐ NO (if no, please include explanation)

List items that don't meet full KETS standards (Use separate sheet if needed or Excel worksheet)

Existing Cable Systems in Building:

Data cable type _____ (UTP, Coax, Token Ring Type 1,2,3)

Data connectors type _____

Fiber and connectors type _____

Video Cable and connectors type _____

Voice Cable and connectors type _____

Voice or data connect blocks type _____

Voice, Data, or Video Layout diagrams available? ☐ YES ☐ NOUsing existing Data, Voice, and Video Distribution systems? ☐ YES ☐ NOList type of distribution system (e.g. conduit, ducts, O-rings, ladders):

_____Existing Distributions Diagrams available to Engineer? ☐ YES ☐ NOExisting Voice System? ☐ YES ☐ NOPower Layout Diagram available to Engineer? ☐ YES ☐ NOMechanical Layout Diagram available to Engineer? ☐ YES ☐ NOCampus or Single Building network design? ☐ Campus ☐ Single**Checklist Data (Use separate sheet if needed):***All items shall be answered in a legible format. If an item does not apply it must be identified as "not applicable" or "this does not apply to the scope of this work".*

All original signatures must be acquired and submitted with this document.

This document serves as a scope of work for the identified project. It should be indicated for every item exactly how this particular issue will be implemented and how this meets KETS standards. Do not turn in a replication of the Building & Wiring Explanation but in your own words describe the implementation and any deviation with justification.

1. Statement addressing KETS standards:
2. Plenum Cable Required? ☐ YES ☐ NO If YES, explanation for requirement:
3. Minimum CAT 6 UTP Specification and Maximum Cable lengths for this project:
4. Backbone Distribution
 - A. Data
 - B. Voice
 - ☐ Analog/Digital/Traditional
 - ☐ VoIP
 - C. Video
 - ☐ Analog/Digital/Traditional
 - ☐ Video/IP
5. Horizontal and Vertical Distribution for Data, Voice, and Video Cabling:
6. Ceiling and Under Floor Distribution:
7. Riser Access:
8. Main Feeders:

9. Building to Building (Campus) UTP or Fiber wiring:

10. Data Lines to a Room:

11. Floor Conduit Size:

12. Drilling through walls or support structures:

13. Power considerations:

14. EMI considerations:

15. Distribution Frame (DF) Characteristics:

16. Distribution Frame Equipment:

17. Distribution Frame Room:

18. Mounting Equipment:

19. Block Alignment:

20. Connect Block:

21. Cable labeling:

22. Testing Activities:

23. Documentation:

24. Qualified Designers:

Signatures: (I verify the above data is valid to the best of my ability)

Design Contractor _____ Date _____

Printed Name _____

CIO _____ Date _____

Printed Name _____

KE Review _____ Date _____

KIDS Review _____ Date _____

Classroom

Classification: New Structure, Renovation

Item: Fixed Interactive Whiteboard Systems – used for presentation and instruction

Hardware

All systems must be at least 64" for a classroom size of 25 students.

All systems must have Wall mounts bracket, desktop stand or floor stand on wheels.

All systems must have replacement pens on hand should one fail or be lost to reduce downtime and Total cost of ownership.

All systems must have glare prevention to minimize eye strain.

All systems must have touch-sensitive basic operation to use without the benefit of special pens.

Administrative Items to be considered:

Software

1. Vendors must include software and free, online upgrades.
2. Software must be available for Windows and Macintosh.
3. Network administrator must be able to perform a silent installation of the interactive whiteboard software.

Types of Projection Displays

1. **Front Projection** - Projector sits in front of the whiteboard and projects the computer image on the whiteboard. The projector can sit on the table or mount on the ceiling.
2. **Rear Projection** - Projector is mounted behind the whiteboard and a series of mirrors project the image on the screen.
3. **Overlay for Flat-Panel Plasma Display** - A plasma screen overlay is a device that fits over a plasma screen. Plasma screens which have an interactive overlay on them work in exactly the same way as interactive whiteboards

Funding Sources:

KETS (S/L), Local (L), Facilities (F)

Related Documents:

- [Interactive White Board Standard](#)

Classroom

Classification: New Structure, Renovation

Item: Projector(s) – Presentation and Instruction Device

Hardware

There are three platforms to consider

1. **Fixed - Fixed Data/Home Theater Projectors:** A projector weighing 10 lbs or greater and intended for fixed installations supporting medium to large classrooms, conference rooms, and auditoriums.
 - A) **Display Technology:** A portable projector will most likely be found in triple chip LCD and Single Chip DLP configurations. Triple chip LCD mobile projectors will cost less than single chip DLP projectors in most cases.
 - 1) Triple Chip LCD
 - 2) Triple Chip DLP
 - 3) LCOS (AKA :Poly Silicon)
 - 4) CRT (The price of CRT projectors will limit installations to large auditoriums)
 - B) **Aspect, Contrast Ratio and Lumens:** A fixed projector will be driven by the type of content/data to be projected. Expect the added cost of an A/V switch or dedicated A/V rack when installing a fixed projector. A professional A/V rack will include built rack mounted DVD, VCR, PC and ports for other input and output devices, think surround sound. A minimum contrast ratio of 700:1 for a fixed projector will be fine for most uses. The amount of lumens needed in the fixed category of projectors will depend on the setting the projector will be used in. Fixed projectors will typically be anywhere from 2000 – 4000+ Lumens.
 - 1) 4:3, 5:4, 16:9 and 16:10 Aspect Ratio
 - 2) 700:1 - 2000:1 Contrast Ratio
 - 3) 2500 – 4000 Lumens
 - C) **Display mode and Resolution:** The display mode of the projector will be dictated by the input device such as a multiple computers, laptop, PDA, UMPC, TV, DVD/VCR, Set Top Box and video conferencing hardware.
 - 1) XGA for a standard definition (400i), aspect ratio of 4:3 at 1024X768
 - 2) WXGA for a high definition (720p), aspect ration of 16X9 or 16:10 at 1280x720 or 1280x800
 - 3) WSXGA or WXGA+ for a high definition (exceeds 720p), aspect ratio of 16:10 at 1440x900
2. **Mobile Projectors:** Projector weighing less than approximately 5lbs³ and intended for mobile presentations or sharing of projector equipment in small offices and classrooms.
 - A) **Display Technology:** A mobile projector will be easiest to find in a LCD configuration and will be much cheaper than a similarly sized DLP projector. Most mobile projectors weight and cost considerations dictate a single chip LCD.

³ Weight is used for the purposes of helping to define type or flavor (mobile, portable, etc.) of projector.

- 1) Single chip or Triple Chip LCD
- B) **Aspect, Contrast Ratio and Lumens:** The aspect ratio of a mobile projector will be driven by the type of content/data to be projected. s. A minimum contrast ratio of 300:1 for a mobile projector will be fine for most uses.
 - 1) 4:3 or 16:10 Aspect Ratio
 - 2) 300:1 - 800:1 Contrast Ratio
 - 3) 800 – 1500 Lumens
3. **Portable Projectors:** A projector weighing 5lbs or greater and intended for portable presentations or sharing of projector equipment in medium to large classrooms, conference rooms, and auditoriums.
 - A) **Display Technology:** A portable projector will most likely be found in triple chip LCD and Single Chip DLP configurations. Triple chip LCD mobile projectors will cost less than single chip DLP projectors in most cases.
 - 1) Triple Chip LCD
 - 2) DLP Single Chip or Triple Chip
 - B) **Aspect, Contrast Ratio and Lumens:** As with mobile projectors the aspect ratio of a portable projector will be driven by the type of content/data to be projected. Many portable projectors will support 4:3 natively and 5:4 and 16:9 digitally. Portable projectors will typically be anywhere from 1500 – 2500+ Lumens.
 - 1) 4:3, 5:4, 16:9 and 16:10 Aspect Ratio
 - 2) 600:1 - 2000:1 Contrast Ratio
 - 3) 1500 – 2500 Lumens
 - C) **Display mode and Resolution:** The display mode of the projector will be dictated by the input device such as a computer, laptop, PDA, UMPC, TV, DVD/VCR.
 - 1) XGA for a standard definition (400i), aspect ratio of 4:3 at 1024X768
 - 2) WXGA for a high definition (720p), aspect ratio of 16:9 or 16:10 at 1280x720 or 1280x800
 - 3) WSXGA or WXGA+ for a high definition (exceeds 720p), aspect ratio of 16:10 at 1440x900

Funding Sources:

KETS (S/L), Local (L), Facilities (F)

Related Documents:

- [Projector Standard](#)

Workstations

Classification: New Structure, Renovation, or Addition

Item: Workstation Minimum Standards

Global Catalog. The Office of Knowledge Information Data Services (KIDS) uses the 3 tier catalog approach for their approved and latest products offered on the KETS contract.

Vendor products are categorized as either Tier I, Tier II or Tier III under the global catalog.

- Tier I – Tier I products are those that have undergone evaluation by the office of KIDS and have the KIDS and DMPS approval for purchase under the terms of the contract. These products meet the KIDS core standards.
- Tier II – Tier II products have undergone evaluation by the KIDS and have the KIDS and DMPS approval for purchase under the terms of the contract. These are products that do not address a core standard or do not have an approved standard in place.

	Student Instructional Solution (portable)	Student Instructional Solution (stationary)	Student Instructional Solution (mini device)	Teacher and Business Operational Solution (portable)	Teacher and Business Operational Solution (tablet)	Teacher and Business Operational Solution (stationary)
Processor	Installed – 2.0 GHz, Core 2 DUO with 915 chipset	2.8 GHZ Pentium – Dual Core Hyperthreading capable	1.60 GHz,	2.8 GHZ Pentium – Dual Core Hyperthreading capable	1.60 GHz, Core 2 DUO w/915 chipset	2.8 GHZ Pentium – Dual Core Hyperthreading capable
Installed Memory	Installed – Minimum 2GB 1x2GB	Installed – Minimum 2GB 1x2GB	1 GB. 1DIMM (1x1GB)	Installed – Minimum 2GB 1x2GB	2 GB. 1DIMM (1x2GB)	Installed – Minimum 2GB 1x2GB
Memory Expansion Capability	Expansion capability – 8 GB RAM total	Expansion capability – 8 GB		Expansion capability – 8 GB	Expansion capability – 8 GB RAM total	Expansion capability – 8 GB
Cache	Minimum of 2MB, L2 Cache	Minimum of 2MB Integrated L2 Cache		Minimum of 2MB Integrated L2 Cache		Minimum of 2MB Integrated L2 Cache
Slots	Minimum of 1 Type II, PCMCIA slots	2 PCI/PCI X/PCI Express slots		2 PCI/PCI X/PCI Express slots		2 PCI/PCI X/PCI Express slots
Hard Drive	Minimum 80GB storage capacity	Minimum 80GB SATA 7200 RPM	80GB HD or 16 GB SSD	Minimum 120GB SATA 7200 RPM	80GB 4200 RPM	Minimum 120GB SATA 7200 RPM
Audio	Integrated AC97 Audio	Integrated AC97 Audio		Integrated AC97 Audio	Integrated AC97 Audio	Integrated AC97 Audio

Video	128MB video memory or integrated/shared video meeting that level	128MB video memory or integrated/shared video meeting that level		128MB video memory or integrated/shared video meeting that level	Intel 950 Graphics Media Accelerator	128MB video memory or integrated/shared video meeting that level
Graphics Support		Graphics support 1280 x 1024 @ 75Hz		Graphics support 1280 x 1024 @ 75Hz		Graphics support 1280 x 1024 @ 75Hz
Ports - VGA Graphics	1 VGA Video Port	1 VGA/Digital Graphics	1 VGA Video Port	1 VGA/Digital Graphics		1 VGA/Digital Graphics
Ports - Keyboard PS/2 or USB		1 Keyboard USB		1 Keyboard USB		1 Keyboard USB
Ports - Mouse		1 Mouse USB		1 Mouse USB		1 Mouse USB
Ports - Universal Serial Bus (USB)	3 USB Ports (at least 2 must be free after external keyboard and mouse installed)	6 Universal Serial Bus (USB) 2.0	2 USB Ports	6 Universal Serial Bus (USB) 2.0	3 USB Ports (2 must be powered)	6 Universal Serial Bus (USB) 2.0
CD/Rom	Minimum CD RW/DVD ROM	Minimum CD RW/DVD ROM		Minimum CD RW/DVD ROM	24X CDRW/DVD-ROM Combo	Minimum CD RW/DVD ROM
Modem	Minimum of 56k integrated					
Display	Minimum of 14", HPA, Color, 1024 x 768		8.9" Wide Screen 800 x 600		14.1" Wide Screen WXGA LCD	
Battery	Must include one Lithium Ion or Lithium Polymer Battery		Must include one Lithium Ion or Lithium Polymer Battery			
	3-hour usage without plug in		4.5-hour usage without plug in			
Input Devices - Mouse		101 Key Keyboard		101 Key Keyboard		101 Key Keyboard
Input Devices - Keyboard		2 Button Optical Mouse		2 Button Optical Mouse		2 Button Optical Mouse
Operating System	Windows Vista Business	Windows Vista Business	Windows XP Pro installed	Windows Vista Business	Windows Vista Business	Windows Vista Business
Drivers	Shall have all standard and optional drivers installed on each unit	Shall have all standard and optional drivers installed on each unit		Shall have all standard and optional drivers installed on each unit		Shall have all standard and optional drivers installed on each unit
Driver - Network Interface	Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.	Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.	Include, at a minimum, network interface, hard disk, video, etc.	Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.		Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.
Network	Configured with an Internal Ethernet (10/100) adapter	Configured with one (1) Ethernet network adapter (10/100/1000)	Configured with an Internal Ethernet (10/100) adapter	Configured with one (1) Ethernet network adapter (10/100/1000)		Configured with one (1) Ethernet network adapter (10/100/1000)

Network - visual LEDs		Must demonstrate visual LEDs to show link integrity and activity		Must demonstrate visual LEDs to show link integrity and activity		Must demonstrate visual LEDs to show link integrity and activity
Network - automatic sensing reconfig	Configured with an Internal wireless (802.11b/g)	Must have automatic sensing and reconfiguration for the speed of the hub or switch port	1390 WLAN (802.11g)	Must have automatic sensing and reconfiguration for the speed of the hub or switch port	1390 WLAN (802.11g, 54Mbps)	Must have automatic sensing and reconfiguration for the speed of the hub or switch port
Network						
Bay		Must have expandability for one (1) additional internal bay		Must have expandability for one (1) additional internal bay		Must have expandability for one (1) additional internal bay
Energy Star Compliant	Yes	Yes		Yes	Yes	Yes
Warranty	3 years	3 years	2 years	3 years	3 years	3 years

	Analytical and Developmental Solution (portable) **Recommended for CAD or high-end graphics users**	Analytical and Developmental Solution (stationary) **Recommended for CAD or high-end graphics users**
Processor	Installed – 2.4 GHz, Core 2 DUO with 915 chipset	Installed – 2.4Ghz Core 2 Duo
Installed Memory	Installed – Minimum 2GB 1x2GB	Installed – Minimum 2GB 1x2GB
Memory Expansion Capability	Expansion capability – 8 GB RAM total	Expansion capability – 8 GB SDRAM without replacing existing memory
Cache	Minimum of 2 MB, L2 Cache	Minimum of 2 MB Integrated L2 Cache
Slots	Minimum of 1 Type II, PCMCIA slots	2 PCI/PCI X/PCI Express slots
Hard Drive	Minimum 120GB storage capacity	Minimum 250GB SATA 7200 RPM
Audio	Integrated AC97 Audio	Integrated AC97 Audio

Video	256MB video memory or integrated/shared video meeting that level	512MB video memory or integrated/shared video meeting that level
Graphics Support		Graphics support 1280 x 1024 @ 75Hz
Ports - VGA Graphics	1 VGA Video Port	1 VGA/Digital Graphics
Ports - Keyboard PS/2 or USB		1 Keyboard USB
Ports - Mouse		1 Mouse USB
Ports - Universal Serial Bus (USB)	3 USB Ports (at least 2 must be free after external keyboard and mouse installed)	6 Universal Serial Bus (USB) 2.0
CD/Rom	Minimum DVD/RW	Minimum DVD RW
Modem	Minimum of 56k integrated	
Display	Minimum of 15", XGA, Active Matrix, Color, 1024 x 768	
Battery	Must include one Lithium Ion or Lithium Polymer Battery	
	4-hour usage without plug in	
Input Devices - Mouse		101 Key Keyboard
Input Devices - Keyboard		2 Button Optical Mouse
Operating System	Windows Vista Business	Windows Vista Business
Drivers	Shall have all standard and optional drivers installed on each unit	Shall have all standard and optional drivers installed on each unit
Driver - Network Interface	Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.	Include, at a minimum, network interface, CD-ROM, hard disk, modem, video, etc.
Network	Configured with an Internal Ethernet (10/100) adapter	Configured with one (1) Ethernet network adapter (10/100/1000)

Network - visual LEDs		Must demonstrate visual LEDs to show link integrity and activity
Network - automatic sensing reconfig	Configured with an Internal wireless (802.11b/g)	Must have automatic sensing and reconfiguration for the speed of the hub or switch port
Network		
Bay		Must have expandability for one (1) additional internal bay
Energy Star Compliant	Yes	Yes
Warranty	3 years	3 years

Administrative Items to be considered:**Funding Sources:**

KETS (S/L), Local (L)

Related Documents:

Server

Classification: New Structure, Renovation, or Addition

Item: Server Specifications

Global Catalog. The Office of Knowledge Information Data Services (KIDS) uses the 3 tier catalog approach for their approved and latest products offered on the KETS contract.

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- Tier I – Tier I products are those that have undergone evaluation by the office of KIDS and have the KIDS and DMPS approval for purchase under the terms of the contract. These products meet the KIDS core standards.
- Tier II – Tier II products have undergone evaluation by the KIDS and have the KIDS and DMPS approval for purchase under the terms of the contract. These are products that do not address a core standard or do not have an approved standard in place.

Server Specifications				
Tower	Rack Mount Ready	Blade Chassis	Blade Server	Upgrade Options
Processor				
Quad-core 1.6 GHz or the equivalent	Quad-core 1.6 GHz or the equivalent		Quad-core 1.6 GHz or the equivalent	
Memory				
Minimum 4 GB RAM	Minimum 4 GB RAM		Minimum 4 GB RAM	
Cache				
Minimum of 2 MB L2 Cache	Minimum of 2 MB L2 Cache		Minimum of 2 MB L2 Cache	
Integrated Storage				
Minimum 73 GB Mirrored	Minimum 73 GB Mirrored		Minimum 73 GB Mirrored	
Video				
Minimum 16 MB built-in	Minimum 16 MB built-in			
Minimum resolution 1024 x 768	Minimum resolution 1024 x 768			
Hard Drive Controller				
Minimum integrated raid controller	Minimum integrated raid controller			
Power Supplies				
Redundant not required, but	Redundant not required, but			

recommended	recommended			
Hot pluggable not required but recommended	Hot pluggable not required but recommended			
Fans				
Minimum 2	Minimum 2			
Redundant not required, but recommended	Redundant not required, but recommended			
Hot pluggable not required but recommended	Hot pluggable not required but recommended			
Physical Internal Storage				
Minimum 2 drive bays	Minimum 2 drive bays			
Internal DVD-ROM				
8X DVD	8X DVD			
Keyboard				
USB Interface	USB Interface		USB Interface	
Mouse				
USB Interface	USB Interface		USB Interface	
System Bus				
Minimum 3 PCI/PCI X/PCI Express slots	Minimum 2 PCI/PCI X/PCI Express slots (before External SCSI interface or Remote Management Access card)			
Rackmountable				
Capable	Must come rack-mount ready with all rack mount rails, etc, which are specific to server manufacturer.			
External Ports				
Minimum 3 USB port	Minimum 2 USB port			
Minimum 1 VGA port	Minimum 1 VGA ports			
Network				
Configured with one (2) Ethernet network adapter (10/100/1000)	Configured with one (2) Ethernet network adapter (10/100/1000)		Configured with one (2) Ethernet network adapter (10/100/1000)	

Must demonstrate visual property to show link integrity and activity	Must demonstrate visual property to show link integrity and activity		Must demonstrate visual property to show link integrity and activity	
Must have automatic sensing and reconfiguration for the speed of the hub or switch port	Must have automatic sensing and reconfiguration for the speed of the hub or switch port		Must have automatic sensing and reconfiguration for the speed of the hub or switch port	
Must support Category 5e UTP	Must support Category 5e UTP		Must support Category 5e UTP	
Remote Management Access				
Add-on PCI or Built-in	Add-on PCI or Built-in		Add-on PCI or Built-in	
Warranty				
3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	

4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	
5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	
3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair	3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair		3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair	
4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack		4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	
5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack		5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	

Administrative Items to be considered:**Funding Sources:**

KETS (S/L), Local (L)

Related Documents:[Server Standard](#)

Wiring

Classification: New Structure, Renovation, or Addition

Item: All Data, Voice, Video Wiring and Substructure

1. Follow all recommendations per COT wiring standards for data, voice, audio/video and electrical
 - a. Cable installation based on industry standards. The following are applicable:
 1. EIA/TIA-568 Commercial Building Telecommunications Wiring Standard and its appendix, TSB67 level 2, Testing Standard
 2. EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
 3. EIA/TIA-570 Residential and Light Commercial Telecommunications Wiring Standard
 4. EIA/TIA-606 Administrative Standard for the Telecommunications Infrastructure of Commercial Building
 5. EIA/TSB-36 Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables
 6. EIA/TSB-40 Additional Transmission Specifications for Unshielded Twisted Pair Connecting Hardware
 7. FCC Docket 88-57 and related rules regarding inside wire and demarcation points.
 8. IEEE 802.3 Specification
 9. IEEE 10BaseT Specification
2. Follow all local/state wiring codes and restrictions
 - a. KY State Building Codes URL: <http://dhbc.ky.gov/>
3. Wiring Network Designs and Tests
 - a. All CIO's should receive a copy of network drawings and test results as part of construction projects

Administrative Items to be considered:

Plan for future in current design

- Size conduit for additional runs or new wire sizes
- Growth or contraction of student or staff users
- Growth or contraction of Data Center/wiring closets
- Cable guides and ladder racks

Minimum data wire size (10/100/1000) (fiber/10gbt)

- Single mode fiber exterior runs (minimum)
- Multi mode fiber for interior runs (minimum)
- Category 6 minimum for copper (10/100/1000)

Fire suppression in Data Centers/wiring closets

- Removal of water source
- Dry suppression system recommended (i.e. intergen)

Funding Sources:

KETS (S/L), Local (L), Facilities (F)

Related Documents:

APPENDICES

Interactive White Board Standard

Purpose and Scope: Create a standard document with specifications for interactive White Boards that will apply to all Kentucky School Districts.

Reason for Implementing: To create a technical standard to ensure districts purchase interactive white boards that will meet current and future needs for presentation and instruction.

Standard of the Interactive Whiteboard

1. All systems must be at least 64" for a classroom size of 25 students.
2. All systems must have Wall mounts bracket, desktop stand or floor stand on wheels.
3. All systems must have pens with non-mechanical parts and the ability to use the system without pens to reduce downtime and Total cost of ownership.
4. All systems must have glare prevention to minimize eye strain.
5. All systems must have touch-sensitive basic operation to use without the benefit of special pens.
6. Vendors must include software and free, online upgrades.
7. Software must be available for Windows and Macintosh.
8. Software must be able to convert handwritten notes to text.
9. Software must be able to save text directly into applications such as Word and Excel.
10. Software must be able to save notes in different file formats for easy sharing.
11. Software must be able to edit, erase or rearrange order of notes
12. Must be able to record all on-screen activity (whether in the interactive whiteboard software, or any other application, or on the desktop) and audio as a digital video file.
 - a. Must be able to choose to record the full screen, a window or a specified area.
13. Network administrator must be able to perform a silent installation of the interactive whiteboard software.
14. Software content collection includes learning objects including clip-art images, backgrounds, videos, audio clips, Macromedia® Flash® files, and interactivities.

Major Types of Interactive Whiteboards

1. **Front Projection:** In front projection interactive whiteboards, the projector sits in front of the whiteboard and projects the computer image on the whiteboard. The projector can sit on the table or mount on the ceiling.
 - a. Cost less than the rear projection interactive whiteboards and plasma overlays.
 - b. A drawback is that when the presenter stands in front of the whiteboard, he casts a shadow on the screen and has to look into the projector light.

- c. Projectors used with interactive whiteboards have an average of 2,000 hours lamp life and lamps for most projectors are costly to replace.
2. **Rear Projection:** In rear projection interactive whiteboards, the projector is mounted behind the whiteboard and a series of mirrors project the image on the screen.
- a. The advantage of rear projection over front projection is that the presenter doesn't have to look into the projector light when speaking to the audience and the presenter also doesn't cast a shadow on the board.
 - b. The disadvantage is that these systems are usually 5 times more expensive than front projection whiteboards.
 - c. They also take up more room as the back is bulkier due to housing the projector. However, there is also room in the cabinets for a computer base-unit; video recorder/DVD player and many have cable management systems for connecting to visiting laptop computers.
 - d. In-wall systems are also available where the rear-projection whiteboard is built-into a wall that has an area behind it to house the projector. Partition walling, i.e. a false wall, is usually used.
3. **Overlay for Flat-Panel Display:** A plasma screen overlay is a device that fits over a plasma screen. Plasma screens which have an interactive overlay on them work in exactly the same way as interactive whiteboards
- a. plasma screen is a large widescreen monitor, from 32" to 84" in size,
 - b. Advantage of being very thin so that it can be hung on walls.
 - c. Can be used with computers and video recorders/DVD players etc.
 - d. The advantage of using a plasma screen is that a shadow is not cast by the presenter, unlike front projection interactive whiteboards.
 - e. Lifespan of around 30,000 hours use.
 - f. Disadvantage with the plasma screen is the screen size and the high price.
 - g. Gives a far neater finish in a board room environment and far superior pictures when using video recorders, satellite systems or DVD players to show television or video.

Related Documents:

<http://www.theteachersguide.com/SmartBoards.htm>

References:

PROJECTORS

Purpose and Scope: To create a technical standard to ensure districts purchase projectors that will meet current and future needs for presentation and instruction.

1. **Mobile Data/Business Projectors:** A projector weighing less than approximately 5lbs⁴ and intended for mobile presentations or sharing of projector equipment in small offices and classrooms.
 - A) **Display Technology:** A mobile projector will be easiest to find in a LCD configuration and will be much cheaper than a similarly sized DLP projector. Most mobile projectors weight and cost considerations dictate a single chip LCD.
 - 1) Single chip or Triple Chip LCD
 - B) **Aspect, Contrast Ratio and Lumens:** The aspect ratio of a mobile projector will be driven by the type of content/data to be projected. If you will project using a standard laptop or desktop computer expect to project at 4:3 if you are going to be projecting movies or from a wide screen laptop expect to project at 16:10 in most cases. A minimum contrast ratio of 300:1 for a mobile projector will be fine for most uses. The amount of lumens needed in the mobile category of projectors will depend on the setting the projector will be used in. The more the better isn't always true. If the projector in question has a higher contrast ratio and the room the projector is being used in has easily controlled ambient light then lower lumens are fine. Mobile projectors will typically be anywhere from 1000 – 2000 Lumens.
 - 1) 4:3 or 16:10 Aspect Ratio
 - 2) 300:1 - 800:1 Contrast Ratio
 - 3) 800 – 1500 Lumens
 - C) **Display mode and Resolution:** The display mode of the projector will be dictated by the input device such as a computer, laptop, PDA, UMPC, TV, DVD/VCR.
 - 1) XGA for a standard definition (400i), aspect ratio of 4:3 at 1024X768
 - 2) WXGA for a high definition (720p,) aspect ration of 16X9 or 16:10 at 1280x720 or 1280x800
 - D) **Lens Throw:** Projection distance will be dictated by the size of the room in which the projector will be used.
 - 1) The average class room and conference room should be able to handle almost any mobile projector's lens throw.
 - 2) Small offices and small conference rooms should consider utilizing a projector with a short throw lens option.
 - E) **Other Considerations:** Please take the following other items under consideration when selecting a mobile projector.
 - 1) Mobile projectors are just that; mobile, moving around a lot and traveling in lap top bags.
 - 2) Place emphasis of security on the user's ability to keep up with the projector rather than purchasing physical locks.
 - 3) Create a mobile projector kit that goes with the projector in its own case. The kit would include all necessary cables, remote, extra bulb and users cheat sheet to get up and running quickly. Don't forget to check the contents of the kit when the projector is checked back in.

⁴ Weight is used for the purposes of helping to define type or flavor (mobile, portable, etc.) of projector.

- 4) There are some mobile projectors that offer wireless networking. These projectors will allow you to project presentations with out wires. The laptop that you will be projecting from must have either a built in wireless card or a wireless PC card. The card could be kept in the projector kit as well.
 - 5) Projector noise and heat are not as much of a concern with smaller mobile projectors as long as there is good ventilation and low ambient noise in the room it is being used in.
2. **Portable Data/Home Theater Projectors:** A projector weighing 5lbs or greater and intended for portable presentations or sharing of projector equipment in medium to large classrooms, conference rooms, and auditoriums.
- A) **Display Technology:** A portable projector will most likely be found in triple chip LCD and Single Chip DLP configurations. Triple chip LCD mobile projectors will cost less than single chip DLP projectors in most cases.
- 1) Triple Chip LCD
 - 2) DLP Single Chip or Triple Chip
- B) **Aspect, Contrast Ratio and Lumens:** As with mobile projectors the aspect ratio of a portable projector will be driven by the type of content/data to be projected. If you will project using a standard laptop or desktop computer expect to project at 4:3 if you are going to be projecting movies or from a wide screen laptop expect to project at 16:10 in most cases. If you will be projecting from a DVD player you should expect to see a true 16:9 aspect ration on wide screen movies. Many portable projectors will support 4:3 natively and 5:4 and 16:9 digitally. A minimum contrast ratio of 600:1 for a mobile projector will be fine for most uses. The amount of lumens needed in the portable category of projectors will depend on the setting the projector will be used in. As with the mobile projectors the more the better isn't always true. If the projector is question has a higher contrast ratio and the room the projector is being used in has easily controlled ambient light then lower lumens are fine. Portable projectors will typically be anywhere from 1500 – 2500+ Lumens.
- 1) 4:3, 5:4, 16:9 and 16:10 Aspect Ratio
 - 2) 600:1 - 2000:1 Contrast Ratio
 - 3) 1500 – 2500 Lumens
- C) **Display mode and Resolution:** The display mode of the projector will be dictated by the input device such as a computer, laptop, PDA, UMPC, TV, DVD/VCR.
- 1) XGA for a standard definition (400i), aspect ratio of 4:3 at 1024X768
 - 2) WXGA for a high definition (720p), aspect ration of 16X9 or 16:10 at 1280x720 or 1280x800
 - 3) WSXGA or WXGA+ for a high definition (exceeds 720p), aspect ratio of 16:10 at 1440x900
- D) **Lens Throw:** Projection distance will be dictated by the size of the room in which the projector will be used.
- 1) The medium to large class room and conference room should be able to handle almost any portable projector's lens throw.
 - 2) Large conference rooms, class rooms and auditoriums should consider utilizing a fixed projector with a long throw lens option.
- E) **Other Considerations:** Please take the following other items under consideration when selecting a mobile projector.
- 1) Portable projectors are meant for the purposes of temporary location or easy storage in conference rooms or classes that have desk space issues but can't afford to purchase a fixed mount projector.

- 2) Place emphasis of security on optionally purchased physical locks or locked storage. Portable projectors are usually twice the cost of mobile projectors.
- 3) Create a portable projector cart that easily allows for the projector to be moved from room to room. The cart would include all necessary cables, remote, extra bulb and users cheat sheet fastened to the cart. The projector can be physically cable locked to the cart. Don't forget to check the contents of the cart when the projector is checked back in.
- 4) There are some portable projectors that offer wired and wireless networking. These projectors will allow you to project presentations with out wires or monitor there usage of the LAN. The laptop that you will be projecting from must have either a built in 10/100 Ethernet port, wireless card or a wireless PC card. The card could be kept in the projector kit as well.
- 5) Projector noise and heat can be a concern with the larger portable projectors. As long as there is good ventilation and low ambient noise in the room it is being used in there should be no problems. Please be advised that some portable projectors now come with added filters that must be changed out just like your car.

3. **Fixed Data/Home Theater Projectors:** A projector weighing 10lbs or greater and intended for fixed installations supporting medium to large classrooms, conference rooms, and auditoriums.

A) **Display Technology:** A portable projector will most likely be found in triple chip LCD and Single Chip DLP configurations. Triple chip LCD mobile projectors will cost less than single chip DLP projectors in most cases.

- 1) Triple Chip LCD
- 2) Triple Chip DLP
- 3) LCOS (AKA :Poly Silicon)
- 4) CRT (The price of CRT projectors will limit installations to large auditoriums)

B) **Aspect, Contrast Ratio and Lumens:** As with mobile and portable projectors the aspect ratio of a fixed projector will be driven by the type of content/data to be projected. If you will project using a standard laptop or desktop computer expect to project at 4:3 if you are going to be projecting movies or from a wide screen laptop expect to project at 16:10 in most cases. If you will be projecting from a DVD player you should expect to see a true16:9 aspect ration on wide screen movies. Expect the added cost of an A/V switch or dedicated A/V rack when installing a fixed projector. A professional A/V rack will include built rack mounted DVD, VCR, PC and ports for other input and output devices, think surround sound. A minimum contrast ratio of 700:1 for a fixed projector will be fine for most uses. The amount of lumens needed in the fixed category of projectors will depend on the setting the projector will be used in. As with the mobile and portable projectors the more the better isn't always true. If the projector is question has a higher contrast ratio and the room the projector is being used in has easily controlled ambient light then lower lumens are fine. Fixed projectors will typically be anywhere from 2000 – 4000+ Lumens.

- 1) 4:3, 5:4, 16:9 and 16:10 Aspect Ratio
- 2) 700:1 - 2000:1 Contrast Ratio
- 3) 2500 – 4000 Lumens

C) **Display mode and Resolution:** The display mode of the projector will be dictated by the input device such as a multiple computers, laptop, PDA, UMPC, TV, DVD/VCR, Set Top Box and video conferencing hardware.

- 1) XGA for a standard definition (400i), aspect ratio of 4:3 at 1024X768
- 2) WXGA for a high definition (720p), aspect ration of16X9 or 16:10 at 1280x720 or 1280x800

- 3) WSXGA or WXGA+ for a high definition (exceeds 720p), aspect ratio of 16:10 at 1440x900
- D) **Lens Throw:** Projection distance will be dictated by the size of the room in which the projector will be used.
- 1) The large conference room and auditorium should be able to handle almost any fixed projector's lens throw.
 - 2) Large conference rooms, auditoriums should consider utilizing a fixed projector with a long throw lens option.
- E) **Other Considerations:** Please take the following other items under consideration when selecting a mobile projector.
- 1) Fixed projectors are meant for the purposes of fixed locations in conference rooms or auditoriums where large groups of people will gather for presentations utilizing one or more media sources.
 - 2) Place emphasis of security on optionally purchased physical locks and ceiling mounts. Fixed projectors are usually three to four times the cost of portable projectors.
 - 3) Store remote(s) and users cheat sheet with the AV switch or Locked AV Rack. Better yet; assign some one in facilities to provide set ups for all scheduled presentation activities.
 - 4) Most fixed projectors offer wired and wireless networking. These projectors will allow you to project presentations with out wires or monitor there usage on the LAN. Some projectors can even page someone in IT that the filter or bulb needs to be changed. The laptop that you will be projecting from must have either a built in 10/100 Ethernet port, wireless card or a wireless PC card. Most connectivity to fixed projectors will happen at the AV switch or AV Rack.
 - 5) Projector noise and heat can be a concern with the larger fixed projectors. As long as there is good ventilation and low ambient noise in the room it is being used in there should be no problems. Please be advised that some fixed projectors now come with added filters that must be changed out just like your car.

Acronyms/Abbreviations:

Projector Category	
	Front Projector/Projection - refers to a projector that is in front of a screen where as rear projection more often than not refers to large wide screen TVs where a projector in the rear of the TV is providing video. All products included in the document should be considered Front Projection Projectors.
	Data/Business Projector - are projectors that are usually mobile/portable in nature and often thought of as being associated with computers. Data projectors are not limited to slide presentations and are capable of displaying video feed at various resolutions.
	Home Theater Projector - are projectors usually associated with movies but can be just as capable to display computer images. Home theater projectors can be as inexpensive as 400.00 or as expensive as 30,000.00. Basically when it come to home theater the skies the limit. Home theater projectors often will have more connection and configuration options over a Data/Business Projector.
	Fixed - are projectors that are large enough for medium to large conference spaces and auditoriums that must be attached permanently. Permanent attachment is considered when the projector is a dedicated piece of AV equipment associated with a room that has a fixed screen and audio system.

	<p>Portable - are projectors that may be moved around from conference room to conference room within a facility. Portable projectors may also serve as a permanent projector within a given room but still needs to be moved occasionally with in that room.</p> <p>Mobile - are projectors that travel along side mobile workers and should be able to fit into a laptop bag and usually weighing 3lbs or less.</p> <p>Pocket - an emerging technology that applies the use of a very small projector to the handheld and mobile computing platforms. These projectors are not readily available and many manufacturers are promising shipments in 2007-2008. Think about UMPC when considering a pocket projector. Among the fundamental problems with ever-shrinking mobile phones, personal digital assistants, digital cameras, and other portable devices is that they carry more and more of our data, but they are decreasing in size such as to make them inconvenient to use in certain respects. Building tiny projectors into these devices may offer a practical solution. Research teams have developed miniature hardware and software that can project digital images onto whatever surface is handy—the wall, say, or a desktop—and make them look good even if the impromptu screen isn't nice and smooth.</p>
Display Technology	<p>CRT/Cathode Ray Tube - This is the largest and most experienced player. Many of you have probably seen this kind of projector at a sports bar or in an auditorium at a school. CRT utilizes three tubes, sometimes called 'guns.' The three colors combine or converge to make your image. CRTs do not have a fixed number of pixels, making them versatile machines capable of clear images from higher or lower resolution sources. CRTs also require periodic 'calibration' by a trained professional, which can mean additional expense for the end user down the road. These projectors are generally used in fixed installations because of their size. CRTs are typically not as bright as the other technologies, but the refined picture quality of a properly calibrated CRT is tough to beat.</p> <p>LCD - LCD projection technology is the current leader of the pack, having captured the majority of the market share of all projectors sold. Most LCD projectors have three panels. Each panel is a prism that allows blue, red, or green light through its pixels. These separate colors are then converged and projected. Electrical signals turn on pixels within a set based on the resolution of the unit. LCDs are known to produce greater color definition, offering more shades or variations of color than single-chip DLP™ projectors. DLP™ projectors can sometimes burn definition out of the highlights and shadows with their vibrant colors. Newer LCD projectors include special optics enhancers like micro-lens array that minimize pixelization known as the "screen door effect." New LCD projectors have contrast ratios as high as 800:1. By comparison, DLP™ projectors contrast ratios are as high as 3000:1. The portability and brightness of LCD projectors have made them a popular choice for traveling presenters. The lightest LCD projectors weigh-in at about 4 lbs.</p> <p>3LCD/Triple Chip LCD In early 2006 three-panel/triple chip LCD projectors were significantly cheaper than three-chip DLP projectors. In part because of the rainbow effect that some viewers experience with single chip DLP projectors three chip/panel LCD projectors are considered better than single chip/panel LCD and DLP projectors for TV and home cinema.</p>

	<p>DLP™ (single chip) - Digital Light Processing The single-chip DLP™ is the most portable of all our players. Currently you can find single-chip DLP™ projectors that weigh less than 2 pounds. Digital Light Processing is the product of the great minds at Texas Instruments. DLP™ uses a single Digital Mirror Device (DMD) chip that has thousands of tiny mirrors, each representing a single pixel. These mirrors tilt back and forth and deflect light as indicated by the source to create the image. One limitation of DLP™ technology thus far is brightness. Currently most of the brightest single-chip DLP™ projectors on the market are just 3,000 lumens compared to the 6,000+ lumens of comparably priced LCD's and three-chip DLP™ projectors. Brighter single chip DLP™ projectors are available, but are significantly more expensive. However, because of their deep, rich blacks and high contrast ratios, LP™ projectors have been a popular choice among home theater enthusiasts.</p> <p>The three-chip DLP™ has the best looking images of all the players. The three-chip system is much like the single-chip DLP™ only better. The image quality of the three-chip DLP™ is unsurpassed. Unfortunately it is also the most expensive. Today's three-chip™ DLP projectors cost anywhere from \$15,000-\$30,000 or higher. Unlike CRTs and single-chip DLP™ projectors, three-chip DLP™ can have very high lumen output levels.</p> <p>LCOS/Liquid Crystal on Silicon is a "micro-projection" or "micro-display" technology typically applied in projection televisions. It is a reflective technology similar to DLP projectors; however, it uses liquid crystals instead of individual mirrors. This is contrary to LCD projectors which use a transmissive approach. In LCOS, liquid crystals are applied directly to the surface of a silicon chip coated with an aluminized layer, with some type of passivation layer, which is highly reflective.</p> <p>LCOS technology can produce much higher resolution imagers using highly advanced silicon technology than liquid crystal display and plasma display technologies, which makes it less expensive to implement in such devices as televisions.</p>
Video Input Formats	
	<p>A projector may support several different video input formats, each with different resolutions, colors, and compression.</p> <p>NTSC,1 NTSC 4.43 - U.S. standard National Television System Committee - 480 lines of data, displayed at 30fps - NTSC image are drawn 60 times a second</p> <p>PAL,2 PAL-M, PAL-N - European and international standard Phase Alternating Line - 576 lines, displayed at 25fps - PAL images are drawn 50 times a second</p> <p>SECAM3 - French and international standard</p> <p>SDTV (480i)</p> <p>EDTV (480p)</p> <p>HDTV4 (1080i/P, 720P, 480i/P) - New standard being adopted internationally</p>
Aspect Ratio	<p>The width-to-height ratio of a film or television image. A 4:3 display produces an image that is more square, and a 16:9 ratio produces an image that is more panoramic in shape.</p> <p>The 4:3 aspect ratio is typically associated with standard and enhanced resolution TV's, Computer Displays and most data projectors.</p> <p>The 16:9 aspect ratio is a movie standard and High Definition standard found in some CRT TVs but mostly in Rear Projection and Stand alone LCD and Plasma Televisions. Wide Screen notebooks and LCD display's for computers are typically 16:10. Some home theater and data projectors are starting to offer native 16:9 or digital scaling which is not as desirable as the native aspect ratio.</p>

Contrast Ratio	
	Contrast is the ratio between the white and black parts in an image. The larger the contrast ratio of a display device, the greater is the difference between the brightest whites and the darkest blacks a video display or projector can show. A contrast ratio of say 300:1 would imply that the black level is 300 times darker than the white.
	Most home theater projectors are rated at between 500 and 3000 to 1 contrast ratio, while some of the latest plasma displays have a quoted contrast ratio of 10,000:1.
	Black can only be as black as the projection screen surface is in the ambient light present in the room. Hence, if the room is not pitch dark, the screen surface will reflect some light - thus turning black into dark gray, and therefore reducing image contrast ratio.
	Contrast Ratio Guide
Lumens	
	A measurement unit of total illumination.
	A rating of 1000 to 1500 ANSI lumens or lower is suitable for smaller rooms with controlled lighting or low ambient light. Between 1500 to 3000 ANSI is suitable for medium sized rooms with some ambient light or dimmed light. Over 3000 ANSI is appropriate for very large screens in a large room with no lighting control (for example, a conference room).
	Lumen Guide
Display Modes	
	Are often a combination of display resolution (specified as the width and height in pixels), color depth (measured in bits), and refresh rate (expressed in hertz). Associated with the screen resolution and refresh rate is a display adapter.
	VGA Video Graphics Array, introduced in 1987 by IBM. VGA is actually a set of different resolutions, but is most commonly used today to refer to 640 × 480 pixel displays with 16 colors (4 bits per pixel) and a 4:3 aspect ratio. Other display modes are also defined as VGA, such as 320 × 200 at 256 colors (8 bits per pixel) and a text mode with 720 × 400 pixels. VGA displays and adapters are generally capable of Mode X graphics, an undocumented mode to allow increased non-standard resolutions.
	Display resolution (pixels) 640×480 640×350 320×200 720×400
	Aspect ratio 4:3 64:35 16:10 9:5
	SVGA Super VGA , a video display standard created by VESA for IBM PC compatible personal computers. Introduced in 1989.
	Display resolution (pixels) 800×600
	Aspect ratio 4:3
	XGA Extended Graphics Array is an IBM display standard introduced in 1990. XGA-2 added 1024 × 768 support for high color and higher refresh rates, improved performance, and support for 1360 × 1024 in 16 colors (4 bits per pixel).

Display resolution (pixels)
1024×768
640×480

Aspect ratio
4:3

SXGA Super XGA, a widely used de facto 32 bit Truecolor standard, with an unusual aspect ratio of 5:4 instead of the more common 4:3 which means, if scaled, images appear wider on SXGA displays than most other resolutions. The resolution probably should have been 1280 × 960 which is a popular standard resolution for Unix workstations.
* Some manufacturers, noting that the de facto industry standard was VGA (Video Graphics Array), termed this the Extended Video Graphics Array or XVGA.

Display resolution (pixels)
1280×1024
Aspect ratio
5:4

UXGA Ultra XGA is a de facto Truecolor standard and has the highest resolution of any normal aspect ratio (4:3) display in production.

Display resolution (pixels)
1600×1200

Aspect ratio
4:3

WUXGA Widescreen Ultra Extended Graphics Array is a version of the UXGA format. This display aspect ratio is becoming popular in high end 15" and 17" widescreen notebook computers.

Display resolution (pixels)
1920×1200

Aspect ratio
16:10

WQXGA Widescreen Quad Extended Graphics Array is a version of the XGA format. This display aspect ratio is becoming popular in some recent desktop monitors.

Display resolution (pixels)
2560×1600

Aspect ratio
16:10

WXGA Widescreen Extended Graphics Array is a version of the XGA format. This display aspect ratio is becoming popular in some recent notebook computers.

Display resolution (pixels)
1280×720 or 1280×800

Aspect ratio
16:9 or 16:10

WSXGA, or WXGA+ Widescreen Extended Graphics Array PLUS is a version of the WXGA format. This display aspect ratio is becoming popular in some recent notebook computers.

Display resolution (pixels)

	<p>1440×900</p> <p>Aspect ratio 16:10</p> <p>802.11b/g wireless video connection should be able to present HDTV 1080i and even 720p however all issues wireless connectivity such as interference should be considered when purchasing a projector with this option. This option will be primarily found on business class data projectors that HDTV is not usually a concern to the average business user.</p>
Resolution	<p>Refers to the sharpness and clarity of an image. The term is most often used to describe monitors, printers, and bit-mapped graphic images. When referring to monitors or projectors the terms screen or display resolution are most often used.</p> <p>SDTV 480i - The native resolution of an analog or standard definition TV is not known as it does not use pixels to measure definition but 640X480 is an approximation. 480i is the correct designation for SDTV. The "i" in 480i stands for interlaced. Please see the next description for some clarification on this matter.</p> <p>EDTV 480p - The native resolution of Enhanced Television is 852X480 and 480p is correct designation for EDTV. The "p" in 480p stands for progressive. Without going into the technical differences between progressive scan and interlaced displays think of progressive scan as the display producing every frame as a single photograph and interlaced as 2 photos begin displayed with every other line missing and have to be switched back and forth quickly enough so the human eye perceives them as one image, AKA: POV.</p> <p>HDTV 1080i, 720p, 1080p - The native resolution High Definition Television is 1024x768 and 1080i is the correct designation for HDTV and is the most common HDTV broadcast format. The 720p is an alternate designation for HDTV that is actually progressive and is measured as 1280X720, 1280X768, or 1366X768. The newer 1080p is not widely supported yet and is not a broadcast standard however the new Blue Ray DVD format uses this resolution that measures in at 1,920x1,080. The 1080p designation on projectors and displays may not be native as this resolution may be accomplished via a line doubler rather than a native resolution.</p>
Lens Throw	<p>AKA projection distance - A common throw distance is one foot of screen for every two feet of space between projector and screen. That is a general rule for projectors with a standard lens.</p> <p>Short throw lens projectors are able to create larger images with less distance between projector and screen. This is helpful in small class rooms and conference rooms.</p> <p>Long throw lens projectors help create smaller, more viewable images from greater distances. A long throw lens is advantageous in large venues, particularly in fixed installations. Churches often require long throw lenses for worship spaces, because the projector is often mounted far away from the screen, behind the congregation. Without a long throw lens, the image would be too large.</p> <p>Projection Calculator Pro</p>
Network Connectivity	<p>networkable projectors have RJ-45/Ethernet connections so that the projector can be accessed through a LAN or WAN. Some newer projectors are shipping with built in wireless routers as well. This gives IT departments the ability to manage projectors the same way other peripherals are managed. That means remote access and control to perform routine, sometimes time consuming and costly, tasks like troubleshooting, monitoring performance, and shutting down projectors throughout a large facility. Centralized monitoring enables projector operators/managers to save time by simultaneously viewing the status of all network projectors over their LAN including but not limited to input sources, power on/off and lamp life conditions. Built-in remote access also gives users virtual control of the projectors from remote locations over a network with the ability to</p>

	troubleshoot and monitor them and even using e-mail notification.
	10/100
	10/1000
	802.11b
	802.11g
	802.11b/g
Other Features to Consider	
	Keystone Correction - Digital (cheap) or Optical (expensive)
	Lens Shift: The Lens Shift feature of a projector allows the optical lens to be physically shifted up and down (vertical) and/or left and right (horizontal). Some lens shift mechanisms are motorized with vertical lens shift being the most popular. Lens shift will can avoid or minimize the need for keystone correction. It is also used to geometrically align images when stacking projectors.
	Some cables - some projectors that offer all of the inputs in the world will limit there in the box cables usually to the least common denominator of the bunch. So if the projector has an HDMI and an s-video connector do not be surprised to find only one or the other. If the projector has audio support for FireWire, SPIDF and or optical do not be surprised not to find them in the box. Digital audio connects are expensive compared to RCA connects.
	Mouse and Keyboard - Wired (PS/USB) or Wireless (Infra, RF, Blue Tooth)
	Remote Control with or with out built in laser pointer (Infra RF)
	OSD - On Screen Display
	Multiple Video/computer inputs
	Monitor Pass through - see what's on computer monitor and projector screen.
	Mouse Emulation - This is handled either with a remote control or presentation pointing device. Note: A wireless Key Board and mouse can be beat.
	Built in speaker(s) - most data/business projectors will come with one built in speaker. If you are going to use a fixed projector in a conference room or auditorium a more robust audio system will need to be considered.
	Carrying case - most data/business projectors will come with a soft carry bag. If the projector to be purchased is going to be uses by a "Road Warrior" then a hard case purchase should be considered.
	Security Lock Slot - most data/business projectors will come with such a security slot but not with a cable lock.
	Passcode Security - Portable and fixed data/business projectors will allow for simple password projection with out having to bind to a domain.
Other Concerns	Temperature - How hot a projector ran use to be of large concern in the early days of projectors as the temp alone could cut a meeting short in small conference room. Today's concerns with temperature are more about bulb life and the overall health of the projector. Modern data and home theater projectors will not shut down a fan on projector even after a bulb has gown dark to slowly cool down a projector. Many projectors also have the ability to extend a bulbs life by limiting the lumens produced by the bulb. This is usually done via its OSD or through built in network monitoring tools.
	Sound - ensure that the decibels of an operating projector do not exceed the ability of viewers to hear a presenter or video. It must also be said that room size will also play a

	larger part in this.
	Bulb Life - Be realistic when choosing a projector and its usage. Be aware of the MFG's specs on bulb life and what replacement bulbs will cost. In some of the mobile and portable projectors the bulb can be as much as two thirds the purchase price. The new pocket projectors will be using LEDs so this discussion is not important.
	Physical Security - Is it possible to lock the projector with a cable lock
	Network Security - Can the device bind to the AD Domain or can it only be access using a built in pass code?
	Remote control - Infra Red vs. RF/Radio Frequency.

List of Appendices:**Related Documents:****References:**[Outfitting Classrooms](#)[High Definition: The Big Picture](#)[Projector Central](#)[Projector People](#)[Projector Reviews](#)[About - Home Theater](#)[cNet - Projector Reviews](#)[Audio Video Revolution](#)[Best Buy's guide to Projectors](#)[Big Screen Forums](#)[Audio Video Science Forum](#)

Wireless Local Area Networks (WLAN)

Purpose and Scope: Wireless networks must be carefully planned in order to provide a secure and reliable service to the end user. Although, this document is not intended to be a comprehensive guide to the implementation of wireless technology, it should be treated as a baseline for securing wireless networks.

Reason for Implementing: The Office of Knowledge information Data Systems (KIDS) is responsible for ensuring that the Kentucky Education Technology Systems (KETS) statewide network is secure and reliable. Over the past several years Wireless Local Area Network (WLAN) communication has become an increasingly popular means of connecting mobile devices such as laptops, PDAs and Smart Phones to the Internet and the Local Area Network. The number of planned and previously implemented Wireless LANs has increased to the point that standards and practices need to be articulated for this network service.

1) WLAN Acceptable Use

- A) Any user that requires access to wireless network services should be required to read and sign a copy of the district or school's Acceptable Use Policy prior to gaining access to the Wireless Network.
- B) Users should understand that wireless networks are inherently insecure. Therefore, the transmission of sensitive/confidential data should be encrypted at the application layer (i.e. SSL, SSH) or should not be allowed to be accessed via wireless network.

2) Installation and Security

A) Access Control (MAC address filtering) / 802.1x Authentication

- 1) Although, it is highly recommended that 802.1x authentication be implemented in conjunction with Media Access Control (MAC) address lists, it is not a requirement at this time. For small wireless network installations (e.g. <30 devices) Media Access Control (MAC) address lists may be used in place of 802.1x Authentication. For larger wireless network installations (e.g. >30 devices) 802.1x Authentication must be implemented. In either small or large deployments, if 802.1x Authentication is implemented, Media Access Control (MAC) address lists are not required.

B) Configuration Passwords

- 1) All Wireless Access Point (WAP) management interface passwords must be changed from the default. Passwords must be difficult to guess and at a minimum be alphanumeric 8 or more digits in length. See the [SANS Institute's Password Policy](#) for more information on creating secure passwords.
- 2) All Wireless Access Point (WAP) management interface passwords should be changed periodically to reduce security threats.

C) Connectivity

- 1) Ethernet hubs transmit data to every device on the network segment, including wireless devices. An intruder would not only be able to see the data transmitted via the wireless

network, but all devices connected to the segment including hard wired LAN devices.
Therefore, all Wireless Access Points (WAP) must be connected directly to an Ethernet switch.

D) Dynamic Host Configuration Protocol (DHCP)

- 1) Some Wireless Access Points (WAP) can be configured to give out Dynamic Host Configuration Protocol (DHCP) addresses directly. All Wireless Access Points must not be configured to assign DHCP addresses. Instead, they should be configured as a pass-thru or bridge device and allow Active Directory to assign and manage all DHCP address assignments.

E) Network Address Translation (NAT)

- 1) Network Address Translation (NAT) allows several wireless devices to share a single IP address on the Local Area Network. This feature must be disabled on all Wireless Access Points because any accountability for those wireless devices would be lost.

F) Encryption

- 1) All Wireless Access Points (WAP) must be configured with the highest possible encryption available. 128-bit Wi-Fi Protected Access (WPA) is preferred. However, some legacy devices do not support WPA, therefore it is not required. In such cases 128-bit Wired Equivalent Privacy (WEP) must be used.
- 2) All Wireless Access Point (WAP) keys must be changed on a periodic basis.

G) Physical Security and Placement

- 1) Wireless Access Points (WAP) should not be placed in locations that make them easy for someone to steal. All Wireless Access Points (WAP) should be either placed in a locked wiring closet, placed in a lockable enclosure, hidden from site above ceiling tiles or secured in such a way that removing them would damage them.
- 2) A vendor site survey is not required prior to the implementation of a Wireless Local Area Network (WLAN), however it is recommended. As the placement of the Wireless Access Point (WAP) must be carefully planned and should take the following into consideration:
 - (a) If Wireless Access Points (WAP) that are on the same RF channel are placed too close to one another, the overlap may result in interference in the overlapped area.
 - (b) Wireless Access Points (WAP) should be strategically located to prevent the interception of wireless signals by unauthorized individuals. The range must be tested to ensure that signals are not being transmitted outside the intended coverage area.
 - (c) Wireless Access Points (WAP) must be installed so they do not violate state or local fire codes.
 - (d) The number of devices a Wireless Access Point (WAP) can support can differ depending on the type of use that is expected. The following should be used as an initial starting point for determining the number of Wireless Access Points (WAP) that are required to provide Wireless Local Area Network (WLAN) coverage.
 - (e) Heavy Usage – (up to 20) devices all accessing the network concurrently to access web pages, low to medium quality streaming video, large file transfers, etc.
 - (f) Medium Usage – (21 to 40) devices using the network, but not in a coordinated fashion. For example all working independently on projects, etc.

- (g) Light Usage – (41 to 60) devices using the network on a casual basis and concurrency of use is random and minimal. This would also include large numbers on concurrent users accessing low bandwidth applications such as email.

H) Security Review

- 1) Periodic security reviews should be performed to ensure that changes to the Wireless Local Area Network (WLAN) have not exposed the network to intruders.
- 2) The network should be periodically scanned to detect unauthorized wireless devices.

I) Security Switch

- 1) Wireless Security Switches are not required as long as all security measures outlined in this document are met. However, wireless security switches are highly encouraged in large deployments due to the many benefits that they provide including: Centralized Management for up to 120 Wireless Access Points, Acceptable User Policy Enforcement, Quality of Service (QoS) Policy Enforcement, Usage Tracking, Location Tracking, etc...

J) Service Set Identifier (SSID)

- 1) The Service Set Identifier (SSID) should not openly identify the Local Area Network (LAN) or its purpose and should be constructed as securely as a password.
- 2) The regular broadcasting of the Service Set Identifier (SSID) must be disabled on all Wireless Access Points (WAP).

K) Simple Network Management Protocol (SNMP)

- 1) Simple Network Management Protocol (SNMP) settings should be changed from the default and should have access control lists where possible.

L) Updates (Firmware & Software)

- 1) Software and Firmware updates from the wireless manufacture(s) should be applied to Wireless Access Points (WAP) and wireless devices as soon as possible after release to correct any security vulnerabilities.

M) Virtual Private Network (VPN) Integration

- 1) Virtual Private Network (VPN) Integration is currently not required in Wireless Local Area Network (WLAN) deployments. However, VPN solution can be utilized to provide an extra layer of protection between the WLAN and the LAN.

N) Wireless Local Area Network (WLAN) Technology

- 1) All Wireless Access Points (WAP) must support 802.11 a/b/g standards and n once standard has been adopted.

Approved Vendors:

- Enterasys Networks
- Nortel Network

Acronyms/Abbreviations:

- DHCP - Dynamic Host Configuration Protocol
- MAC Address - Media Access Control Address
- NAT – Network Address Translation
- SNMP – Simple Network Management Protocol
- SSID – Service Set Identifier
- VPN – Virtual Private Network
- WAP – Wireless LAN Access Point
- WEP – Wired Equivalency Privacy
- WLAN – Wireless Local Area Network
- WPA – Wi-Fi Protected Access

VPN Remote Access to the KETS Network

Purpose and Scope: To establish the methods for VPN access to KETS networks using the products and devices supported by KDE the Agency.

Reason for Implementing: To standardize the methods used and ensure the security of the KETS network by establishing a single method of secure remote access to the KETS network and related resources within said network.

VPN Remote Access

1. Functionality

A) Nortel Contivity Hardware

- 1) The hardware purchase, ownership and administration will be provided by KDE the Agency.
- 2) Districts and 3rd Party Service providers will not be allowed to establish an alternate means of remote access to the KETS network.
- 3) Access will be granted on approval of request by KDE the Agency.
- 4) All access and administration of access permissions will be administered by KDE the Agency, including the establishment of an account, access permissions, suspension and/or removal of an account.

B) Desktop Solutions – Specific Designated Software Solution

- 1) Only the Nortel Contivity VPN Client software is permitted for use for VPN remote access to the KETS network.
- 2) Nortel Contivity Client software will be provided upon request and approval. KDE the Agency will provide the client software and connectivity instructions upon approval.

C) Request Process and Internal Support

- 1) Request for access to the VPN remote system can be made through the KETS Service Desk.
- 2) The KETS Service Desk and related KETS Service Teams will support the host devices and client software components.
- 3) Escalated issues will be forwarded to the product vendor to Tier 3 or higher support.

D) Training

- 1) The KETS Service Desk and related KETS Service Teams will aid the end user in instruction of the use of this product.

Technical and Implementation Considerations:

At the time of the creation of this standards document (February, 2009), it was determined that this implementation of this solution would be done by KDE the Agency using these standards selected equipment.

KDE the Agency will be responsible for the installation and administration of the host system and providing client software for approved end-user use.

Approved Products:

- Nortel Contivity VPN Hardware
- Nortel Contivity VPN Client Software

Acronyms/Abbreviations:

- **VPN:** Virtual Private Network, Usually refers to a network in which some of the parts are connected using the public Internet, but the data sent across the Internet is encrypted. So the entire network is virtually private and secured.

List of Appendices:**Related Documents:****References:**

Video Phone Standard

Purpose and Scope: This document defines the Video Phone hardware and architectural standards to be used by the Deaf and Hard of Hearing Community inside the Kentucky Department of Education and Kentucky K-12 Schools and Districts.

Reason for Implementing: The goal of this initiative is to allow employees who are deaf and hard of hearing to communicate with others both hearing and deaf just as the hearing community uses standard telephone services.

Video Phone

1. The standard device for this service is the Sorenson VRS (Video Relay Service). VRS calls enable deaf or hard of hearing individuals to both make and receive telephone calls. A VRS call involves three individuals in separate locations:
 - A) A deaf or hard of hearing caller who uses VRS equipment/videophone or similar to sign to an interpreter.
 - B) An interpreter who uses VRS equipment/videophone and a phone headset to relay the call
 - C) A hearing caller who uses a standard telephone to communicate, or another deaf or hard of hearing caller using VRS equipment/videophone.

The Sorenson VRS will not function properly on the KETS Network without assigning Public IP address. To allow for this service to function properly, a public IP address must be assigned to the individual unit.

KDE has allocated a block of Public IP addresses for each district that can be used for Video Phones. The Block of addresses will be the top 14 IP addresses from the Firewall NAT range (170.185.x.240 with a subnet mask of 255.255.255.240).

Example: If Clark Co was to require this service: The district would apply the IP range of 170.185.61.241 through 170.185.61.254 to the VRS devices in the district where the Sorenson VRS Video Phone would be used.

The Steps to enable this service begins with a call to the KETS Service Desk. The KETS Service Desk will create a ticket and provide you with the ticket number for your records. After the ticket has been created, the district firewall will be modified to allow the Video Phone to communicate unobstructed. It is the responsibility of the district to configure their network devices for this new IP range as well as the endpoint to be accessible on this public segment without allowing other devices to be plugged in.

Acronyms/Abbreviations:

- VRS – Video Relay System

Related Documents:

District firewall configuration – Contact KETS Service Desk

References:

<http://www.fcc.gov/cgb/dro/trs.html>
<http://www.sorensonvrs.com/>

BUILDING WIRING DESIGN CHECKLIST EXPLANATION

Version 3.2

2011

1. Statement that assures 100% compliance with the following standards:

"This design shall completely follow KETS standards listed in the document "School Construction Technology Checklist Guide" 1.0 dated 10/22/2008 and the 'Building Wiring Design Checklist Explanation version 3.2 dated 2011. The exceptions to this are...

The Building Wiring Design Checklist Explanation document overrides any differences, which may exist between it and the School Construction Technology Checklist Guide document.

2. Plenum Cable:

Plenum cable shall only be used in areas that require it. For example, Plenum cable is used in an open-air return false ceiling. However in Kentucky schools, this is rare. Some vendors are using plenum cable for the whole school whether it is needed or not. Since plenum cable is 3 to 4 times as expensive as PVC, it shall only be used where Kentucky Building Codes or other safety measures require it. In some cases facilities are retrofitted or upgraded to a status requiring plenum installations where previous non-plenum is currently installed. Please be aware of future facilities work. A statement must include evidence that future facilities had been researched and discussed with proper school, district and state authorities.

3. Minimum CAT 6 UTP - Maximum Ethernet Cable Lengths for this Project:

For an Ethernet environment the maximum segment limit from the switch port to a terminal device is 100m. The maximum network length with repeaters is 2500m. Minimum specification for the Ethernet cabling is Category 6.

4. Backbone Distribution Data, Voice and Video:

- a. **Data:** Shall use at least 6-strand 62.5u/125.5u multi-mode fiber. In some cases single-mode fiber is required. Where this is the case please identify the situation, circumstances and requirements.
- b. **Voice:** Cat 6 UTP cable with Amp 50-pin connector for voice.
- c. **Video:** RG-6 or RG-11 with N-type connector for "Traditional" video installations, CAT 6 UTP for Video IP installations.

5. Horizontal and Vertical Distribution for Data, Voice and Video Cable:

Vendor shall use CAT 6 UTP (4-pair) 22/24 AWG cable with RJ-45 connectors at faceplate for data and voice and Video IP. The termination of the wires within the RJ45 connector shall follow EIA/TIA 568A or 568B standards for termination. Shall use RG 6/RG 11 broadband coaxial with F-type connector at faceplate for traditional video. If video over IP is being deployed, Ethernet standards within this document must be adhered to. There shall be extra cable coiled up next to faceplate and 15 to 20 extra feet coiled at the DF. In all cases standards consistency must be maintained. For example: If a facility is currently partially cabled with EIA/TIA 568A this same standard must be maintained throughout the facility with new installations. Please include a statement showing evidence of consistence with addition wiring in buildings. The preferred distribution method shall be the zone technique as opposed to Freestyle. Zone means there are large groups of wire bundled together (e.g. cable trays, J hooks, etc) that is extended throughout the building. Freestyle looks like a spider web where cable is extended individually or in very small groups from a centrally located MDF

6. Ceiling and under floor Horizontal distribution:

The vendor shall describe in detail their approach and their justification for that approach to the district:

Approach #1:

The main feeders should be square ducts, raceways or 2ft ceiling ladders. For a main feeder, there should be pull and splice boxes every 3 to 6m. Conduit should not be used as a main feeder device. Supporting feeders to the main feeder should be metal or plenum hard plastic conduit. If conduit and feeder trays are used then an electrical wire feeder tape can be used to easily and inexpensively install new cable or replace worn or defective cable. This option will be more expensive to install than other methods, but will replace itself in maintenance savings over the life of the cable system. This is because the labor required to install new cable or replace defective cable will be less. Reduced labor equals reduced cost. Having UTP in metal conduit also protects it from EMI.

Approach #2:

Devices like J hooks, single bar supports, O-Rings, and Bridals are discouraged because long-term support and maintenance is more difficult. These devices are acceptable if all the voice and data cable is being installed at the same time in older facilities where cable and ladder trays are cost prohibitive. Otherwise every time a new data or voice line needs to be installed someone is going to have to physically return and weave/secure the new cable every 3 to 6 feet. The labor for this in the long run is time consuming and expensive. This approach also leaves the cable susceptible to EMI. Make sure initially and over time that your electrical contractors are aware of the location of your voice/data cables. Otherwise you will experience many transmission problems. For all NEW installations devices like J hooks, single bar supports, O-Rings, and Bridals are prohibited.

Approach #3:

A combination of approaches 1 and 2.

Older building may require retrofitting using molding that attaches to Crown, Baseboard, or Flank of a room. The tubing, raceways and power poles should have metal separators for power and communication/data lines. 90 degree bends should use curved conduit for UTP. Fiber should have no more than a five-inch bend throughout its run.

7. Riser Access:

Between floors from the MDF to IDF or IDF to IDF shall use Sleeves 10 to 20cm diameter, Slots/Cores, or Conduit 20 cm diameter.

8. Main Feeders:

All Main feeders shall be designed to handle the weight and physical capacity of another 50%.

9. For Building to Building (Campus) UTP or Fiber wiring:*Option 1:*

Shall use environmental Aerial Cable: Clearly marked for physical protection, Special grounding and lightening protection (designed for outdoors) must be installed, tested and guaranteed in writing to meet or exceed all federal, state and local standards applying to lightening protection and installation of aerial fiber optics.

Option 2:

Conduit: Metal, PVC, or ABS 4" to 6" in diameter, encased in concrete or other protective material (gravel), .5m below ground surface.

Option 3:

None or Not applicable

Describe which option you are using in detail and why:

10. Data Lines to a Room:

The average classroom serves 18 students and 1 teacher.

For the Student:

Student data lines may be installed in classrooms, libraries, or other places the district/school requires them. The number of student data lines depends on the District's Phase/UNMET need, further maintenance of, or implementation as described in current KETS Master Plan for Education Technology. The master plan(s) provides funds for 1 data line for every 6 students, plus 50%. This additional 50% is included for installation in locations other than classrooms. This allows for cables to operate labs, libraries, media centers, and other facilities intended for student use outside the traditional classroom environment (*See For Facilities*). If a district wants to install more lines than this, 100% local funds must be used for the number of additional lines installed in excess of the required number. It is strongly recommended that the student data cables be home runs from the MDF or IDF to a separate faceplate. If the vendor does not follow this home run recommendation, then they must explain the reason(s) in detail and have approval from the review process.

Wireless Access Points (WAP) may be used to reduce or eliminate the need for physical wired drops for student data lines. Any wireless design must follow the KETS Wireless Standard practices as documented, following guides regarding the number of workstations per WAP, transmission distance, etc.

See link below:

[KETS Wireless Standards](#)

For the Teacher:

According to House Bill 698, every classroom shall have at least one video (can be located in an area to best serve the classroom), one voice, and one data cable terminated at a faceplate for the teacher. These are resources the teacher may use for instruction and daily operations. For the purposes of this document and to make resource tracking easier, the teacher specific drops will now only include the data and voice drops to be located at the faceplate nearest the teacher's desk location in the room. Other data and video cabling will now be recorded and referenced under "Facility/Classroom".

For the Facility/Classroom Resource Drops

According to House Bill 698, every classroom shall have at least one video located in the classroom. This can be installed in the best location for service in the classroom. Not included in HB 698, but is included in this section of documentation are various additional data and/or video drops that may be added to the classroom or facility (gym, library, hallways, etc). These data drops will include printers, wireless access points (WAPs), projectors, video (IP-Video or Traditional Coaxial), and Smartboards or other Intelligent Classroom devices that are network aware.

For Facility/Administrative/Offices/Data Center:

The master plan provides funds for 2 school administrator data cables per school. Any additional school administrator data cables must be paid for with 100% local funds. It is strongly recommended that the school administrator data cables be home runs from the MDF or IDF to a separate faceplate. If the vendor does not follow this home run recommendation, then they must explain the reason(s) in detail and have approval from the review process. The Building Wiring Checklist may also be altered for wireless architecture that better fits the long term instructional plan of the district by following the guidelines detailed in the KETS Wireless Standard.

See link below:

[KETS Wireless Standards](#)

Data center wiring must follow the cabling requirement minimums for format category and length.

For District Office Administrators:

The master plan provides funds for data cables to be run for an average of 4 per District Office. The District Technology Coordinator can tell you their allotment. Any additional District Office administrator data cables must be paid for with 100% local funds. It is strongly recommended that the District Office administrator data cables be home runs from the MDF or IDF to a separate faceplate. If

the vendor does not follow this home run recommendation, then they shall explain the reason(s) in detail. This guide may also be altered for wireless architecture following the guidelines detailed in the KETS Wireless Standard.

See link below:

[KETS Wireless Standards](#)

It is possible to install one data cable from the DF that connects to a concentrator in the classroom. This approach is highly discouraged because it forces the sacrifice of all major advantages attributable to centralized network management and maintenance. This approach also creates a bottleneck causing severely restricted availability of bandwidth for all workstations in the classroom in question. If this concentrator is an unintelligent or non-manageable device, then its next network connection shall be to a switch in the DF.

11. Floor Conduit Size:

If conduit is used, it shall range from 1 to 5 inches for feeder cable. (A 1-inch conduit may carry up to 6 four pair cables (24AWG) and a 3-inch conduit may carry up to 30 cables.)

12. Drilling through walls or support structures:

Drilling through walls or support structures to install cable can quickly weaken a building's structure. The vendor shall describe any places they will be changing the support strength of a structure. They shall consult a licensed construction or civil engineer before using poke through techniques. They shall ensure proper safety measures are taken and the Kentucky Building Codes are followed.

13. Power considerations:

Education Technology Funds will not be used for power design but the Districts, Designers, and Installers shall consider the following:

Power circuits should be dedicated. When this is not possible power outlets should be isolated from receptacles that will be used for air conditioners, heating, refrigerators, drink machines, power tools, vacuuming, buffing, and maintenance shops. There should be a 20-amp circuit for every 5 workstations and related equipment. Quadruple receptacles. Surge protectors in circuit box for new construction and surge strips for existing systems. Receptacle should be no farther than 5 feet from proposed workstation location. Receptacle should be no farther than 1 foot from faceplate for data ports.

For CDF, MDF, IDF, SDF locations 1 dedicated 20-amp, 110-volt circuit is recommended for each equipment rack or equipment group.

14. EMI considerations:

Each inch of UTP shall be installed the following distances from EMI sources:

Fluorescent or neon lights	12inches or more
Power lines rated at less than 2kva	5 inches or more*
Power lines rated at more than 2KVA	39 inches or more
Transformers and motors	39 inches or more

*UTP may be installed within 5 inches of power lines rated at less than 2kva, providing both are installed in a raceway or conduit that provides physical separation between them. This means that the two are not to be allowed to physically come in contact with each other at any point in the run.

15. Distribution Frame (DF) Characteristics:

The vendor shall describe how their design/install shall address the following concerns:

Location:

- A. CDF (Campus Distribution Frame), centralized location between buildings. Can be located in a separate, dedicated CDF building, a tunnel, or within the central MDF.

- B. MDF (Main Distribution Frame), centralized location within a building located in a manner that maximizes efficient layout of 100m/60m UTP runs. Houses Cross connects, PBX, Communications Equipment and LAN Equipment.

- C. IDF (Intermediate Distribution Frame).

In a multiple floor structure, DF's should be located directly above each other where possible. This allows for greatest simplicity in routing cables between, as well as promoting ease of maintenance in the future. In multiple floor structures, IDF's are often used mainly for Cross-connects, and small communications components

In single floor structures, an IDF is used when cables originating in the MDF cannot reach (goes beyond 100m) every workstation. An IDF shall be connected by Fiber to the MDF.

- D. SIZE of CDF, MDF, and IDF:

For new buildings:

A CDF should contain 200 to 250 square feet of floor space. An MDF should contain 100 square feet.

An MDF should contain 150 square feet when the room is to be shared with file servers, computers, telephone switches, and equipment racks (PBXs, Audio/Video distribution systems, etc...)

An IDF should contain a wall space of at least 3' X 8' (only punch down blocks).

For existing building:

Should follow as close to the above specs as possible.

- E. OTHER CHARACTERISTICS

Cross-connect access:

The primary function of any DF is to house appropriate cross-connect equipment to support the building wiring system.

Communications equipment:

A DF must be capable of supporting communications-related equipment, such as modems and communications servers.

Control equipment:

A DF can include control equipment, such as security devices, if the devices use the telecommunications wiring system within the building.

Some of the functions that a DF must never be used for include the following:

- a. *Power equipment:*

The DF should never house power equipment unless it is directly related to the operation of the housed communications equipment.

- b. *Environmental equipment:*

Unless special A/C for communications equipment is required, there should never be any form of environmental control equipment present.

- c. *Storage facilities:*

Many DF rooms end up cluttered with excess equipment or non-communications-related items. A DF must be kept clean and orderly.

d. Non-telecommunications usage:

A DF should be limited in its use for non-telecommunications functions, such as the DF/office, the DF/coat-room, and the ever-popular DF/rest room (which has happened before).

16. Distribution Frame Equipment:

A DF will usually contain a fixed set of equipment. The vendor shall describe how the design/install addresses the following concerns:

Access point:

Each DF will have a single (usually) location where main distribution or TELCO cables enter the room.

Cross-connect blocks:

There shall be multiple sets of cross-connect blocks used to terminate incoming and outgoing cable.

Patch panels:

Patch panels, providing modularity between cabling and communications systems, have become a mainstay within most DF rooms.

Distribution hardware:

There will be miscellaneous equipment such as cable guides or raceways used to route cabling within the DF room.

Networking equipment:

It is not uncommon to find networking-related equipment within a DF. This includes modems, multiplexers, and local area network (LAN) switches.

Communications power supplies:

Many high-usage communications devices will require an uninterrupted power supply (UPS) to filter power and provide emergency power in case of failure. Additionally, many newer communications devices require special power (i.e., non-110 V or conditioned) to operate.

Line protection:

Most DF rooms will require line protection on all incoming circuits. This protection will help protect end-user and centralized equipment from power or lightning surges that could result in equipment loss or accidental fires.

17. Distribution Frame Room:

The vendor shall describe how their design/install addresses the following concerns:

Single-use facility:

The DF room should be dedicated to communications functions. There shall not be any equipment present that is not directly related to telecommunications (i.e., HVAC ducts, steam or water pipes, electrical cabling).

Security:

Each DF room should be secure with locking doors and limited access through windows (windows should never exist in a DF room).

Access:

Each DF room shall have adequate doorway access to enable the installation of communications equipment.

Dedicated (clean) power:

Each DF room shall have dedicated power circuits unique to communications support. This will help to prolong the life of any power consuming communications equipment placed within the DF.

Common power:

In addition to a dedicated power supply, each DF room shall have an adequate supply of common power outlets for use by maintenance personnel during equipment installation or maintenance (i.e., power tools, exhaust fans).

Grounding system:

Each DF room shall have an approved isolated building ground (common within a building). The ground must be easily accessible with 6AWG cable support.

Tiled flooring:

A DF room shall always have an unfinished concrete (painted) or tiled floor. Carpeted floors are discouraged. Although some designers advocate the use of antistatic carpets, these carpets tend to be expensive, (they have metal grounding coils running through them) and difficult to clean. DF rooms tend to have a great deal of cable clippings on the floor. It is much easier to sweep an unfinished floor than it is to vacuum a carpeted floor (not to mention the electromagnetic interference to your data/voice communications a vacuum causes while in use).

Structural support:

A DF room should be able to support a minimum of 50 psi. This is very important for larger facilities that may house power or large private branch exchange (PBX) or computer equipment.

Non-drop ceiling:

Drop-tile, or suspended, ceilings should not be used within the DF. It is preferable to have direct floor-above access.

Fire protection:

Any room used for housing DF facilities shall have adequate fire prevention and protection systems in place. This will ensure that damage to telecommunications equipment during a fire will be kept to a minimum. Also note that many control systems (security, fire alarms, etc.) that depend upon electronic communications may have cross-connects located within, or may pass through, a DF facility. Additionally, all finished walls within a DF room shall be painted white with a flame-retardant paint. Every DF shall have some form of fire-suppression device in adherence to all Federal, State and Local laws and ordinances.

Environmental control:

Any DF room should maintain a minimum set of environmental parameters. Temperature should be maintained between 10 and 30 degrees C (50 to 85 degrees F) with a non-condensing humidity level of less than 65 to 70 percent. Higher humidity levels can result in corrosion of cross-connect equipment. Temperatures higher, or lower, than the acceptable range can result in improper operation of communications equipment.

Grounding:

It is important for any DF facility to have access to a proper building ground. There should be a single common ground, isolated from any other function. The ground should support access via 6AWG properly bonded cable. All electrical (low or high voltage) systems should be connected to a common ground to decrease the possibility of voltage differences (difference of potential) between service types. All grounding must follow 100% of all federal, state and local laws regulations and ordinances.

Cold Water pipes:

This provides the easiest, lowest-cost, and possibly most-effective source of building grounding. This requires access to a cold water pipe, constructed entirely out of steel that has a minimum soil penetration, without breakage, of at least 3m. The pipe should also be located at least 2 to 3 m below ground level.

Buried grounds:

A buried ground is a large piece of conductive metal that has been buried in open soil. This steel ground may consist of rods, plates, or coils. The size or length of the buried ground will depend upon the type, shape, and thickness of the metal being used (consult an appropriate electrical engineer for exact information on grounding requirements). It is not recommended this be a source of grounding unless a part of the common grounding system for a facility. All electrical (low or high voltage) systems should be connected to a common ground to decrease the possibility of voltage differences (difference of potential) between service types.

Building steel:

It is possible, in some cases, to use the building steel infrastructure as an acceptable ground.

18. Mounting Equipment:

The vendor shall describe how their design/install addresses the following concerns:

All cross-connect equipment shall be either wall-or rack-mounted. Wall-mounted equipment shall be mounted on 3/4-in plywood backboards measuring 4 by 8 ft. The plywood shall be horizontally hung with the bottom of the plywood approximately 0.5 m from the floor and to within 0.5 m of every wall (it is good practice to place plywood backboards on every wall within a DF room). If walls of the DF room extend above 3 m, the backboards may be hung vertically; however, no cross-connect or communications equipment shall ever be placed higher than 2 m off the ground. The plywood shall always be painted with a flame-retardant paint; no backboard should ever be left untreated. In no case shall any cross-connect block or communications component, be installed directly onto a DF room wall, including drywall, concrete, or plywood.

19. Block Alignment:

The vendor shall describe how their design/install addresses the following concerns:

A structured approach to cross-connect block alignment is required in all DF rooms. By convention, voice blocks are mounted above all other blocks, including data and video equipment. Mounting shall be consistent in this fashion. While the vertical alignment separates cross-connect blocks by voice and data affiliation, the lateral configuration separates blocks from incoming and outgoing distribution systems. This vertical and horizontal separation of equipment may vary depending upon the type of media being used. For example, fiber-optic equipment-usually dedicated to data applications is typically housed alongside of twisted-pair voice applications and not underneath as twisted-pair data cross-connect blocks would be located.

All wall-mounted cross-connects shall be mounted on a single wall if possible. There shall be installed one duplex power outlet for each three backboards installed.

All riser cables shall be located in one area, preferably in the corner. Horizontal distribution shall be near the riser cables. Cable shall never enter a room in the middle of a wall. This can force segmentation and will make a structured approach to cross- connect design difficult.

20. Connect Block:

Level 5 wires from the faceplate shall lead to a 110 connect block and Terminate there. In rare cases, termination for data may occur at a concentrator if a School is extremely small (less than 30 students in the entire school).

21. Cable labeling:

- A. Face Plates and the inside of box to which the faceplate is attached shall be marked as voice, data, and video. The room number shall also be written within the box.
- B. Horizontal and vertical cable shall be labeled within 6 inches from the faceplate and 12 inches from the distribution rack. Shall be labeled with the room destination of the cable and the distribution frame name. The type of circuit (data, voice, or video) shall be identified by a label or color codes (e.g. red=data, blue=voice, green=video).

- C. The cross-connect block, patch panel, and splice point shall be clearly marked with a unique identifier.
- D. Labels shall be machine generated, self-laminating and viewable from 360 degrees.
- E. Flag type markers may not be used.
- F. Patch cords greater than 2 feet in length shall have a label on each end.

22. Testing Activities:

The vendor shall describe how their design/install addresses the following concerns:

The following is a list of testing procedures that shall be adhered to for inspecting and testing the distribution hardware:

Structural tests:

The physical distribution system shall be tested for structural integrity (support capabilities) prior to any cable being installed.

Proper labeling:

An inspection shall be performed to ensure that the physical hardware is clearly labeled as telecommunications related.

Hardware inspection:

The entire system, including junction and pull boxes, should be visually inspected for any of the following environmental damage, rust, improper fittings, rough edges, excess moisture, and contact with other systems (electrical, security, etc...) where appropriate.

Grounding:

The system shall be checked for proper grounding, where appropriate.

Fire-stopping:

Any fire-stopping seals shall be carefully inspected. This includes any areas that have been sealed with any material for non-fire-stopping purposes as well.

Faceplate connection:

The connection point between the faceplate and the distribution hardware shall be carefully inspected to ensure that the connection is both properly fitted and that the distribution hardware does not prevent the faceplate outlet box from properly attaching to the supporting structure (wall, floor, ceiling, power pole, etc.).

The following is a list of procedures for inspecting and testing the horizontal distribution cable after installation:

Junction inspection:

Each junction box shall be inspected (where possible) to determine if cables have been scraped against any surface. Look for sheath shavings.

Faceplate inspection:

There shall be ample spare cable beyond the end of the distribution hardware to allow for simplified installation and later re-termination if required. The spare cable can be coiled within the distribution hardware or the housing structure (i.e., in the drywall).

Continuity testing:

Cables shall be tested end to end for signal continuity. This is accomplished with either a tone tester or a proper polarity tester. While these both check for signal continuity, the polarity test is preferred since the tone test can give misleading results, due to signal strength, between multiple pairs of cable. For example, a tone being sent down one conductor can often be detected on other conductors because of crosstalk signals. Another method of testing the cable involves the use of a

time-delay-reflectometer (TDR), which sends a signal down the cable. By measuring the delay in the signal reflection (and the waveform of the reflection), the TDR can determine how long the cable is and if there are any short or open points along the circuit. This can also be used to test the electrical characteristics (including background EMI noise) of a copper cable. Fiber-optic cables should be tested for both signal integrity and signal strength (i.e., dB loss) with an optical TDR (OTDR).

23. Documentation:

The vendor shall provide each of the following to the client within 60 days of completing the installation:

- A. Final As-built drawings showing the location of each network device and the route of each cable.
- B. Materials and components listing for each item such as manufacture, part #, and distributor.
- C. Patching Map. A visual aid that is located on or near the patch panel. Shows device or cable connected to each patch panel position.
- D. Notebook size drawing of facility rooms with network active/passive layout from faceplate to distribution frames.

24. Qualified Designers:

Vendor must be a Registered Communications Distribution Designer or show other certifications the designer has that ensure they are competent to do this kind of work. Just because they know how to install one kind of cable (electrical, voice) is no guarantee they are technically skilled on installing another type (data).

Other Considerations:

The vendor shall describe how their design/install addresses the following concerns:

A. Installation Scheduling:

Hardware installation:

Hardware shall be installed only after the building exterior is completed and the risk of damage to the system by adverse weather conditions has been eliminated. This may not seem a major problem; however, excess water in a conduit or duct system can alter the electrical characteristics of cable placed within the hardware. In any event, only rust-resistant metal should be used.

Ceiling installation:

Ceiling distribution systems shall be installed prior to ceiling tiles being installed.

Conduit and duct installation:

Any conduit or duct system installed within a wall (i.e., feeder conduit between a main duct and an faceplate unit) shall be installed prior to the drywall installation.

Under carpet installation:

Under carpet cabling shall only be installed after the building interior is fully completed. This type of system is easily installed after carpeting has been put in place (assuming that removable carpet tiles have been installed rather than single-piece or glued carpet).

Under floor installation:

All under floor ducts shall be installed during the floor pouring process. This may seem a bit obvious, but it is surprising the number of telecommunications personnel who inquire after a building has been occupied if they can bore holes into concrete floors for conduit or duct. This also applies to trenches that are inset into concrete floors. Although it is possible to cut trenches into established concrete floors, it is often expensive or prohibited because of structural support requirements.

B. Cable access:

Any distribution hardware shall provide sufficient clearance (Greater than 2 feet) into any DF to provide adequate access to cable installers. The exception to this is conduit, which should be terminated within 1 ft of the entrance unless the conduit must reach a specific room or frame location prior to termination.

C. Hardware finishing:

After the installation of any hardware system, all rough edges, such as a connector or pull box joints, shall be filed, de-burred, or covered with plastic coating (plenum-rated if required). Smooth grommets should be installed in any location where cable must pass through rough-cut metal, such as the entrance into a duct system or where cable may pass through metal studs or partitions. Failure to install these grommets can result in cuts into cables, which can sever a conductor and/or diminish performance characteristics.

D. Labeling:

All telecommunications-related hardware shall be clearly labeled as such and be free from any unauthorized cable or equipment (it is surprising how many A/C and power systems are tie-wrapped to telecommunications ladders or conduit for support).

E. Stress testing:

Any hardware installed in a ceiling shall be stress-tested to ensure the hardware is capable of supporting the maximum cable weight as specified by the hardware manufacturer (it is a good idea to add 25 or 50 percent to this weight, given the likelihood of system overloading and those surprise cases where the system must perform an unexpected function).

F. Equipment grounding:

Any metal distribution equipment should be properly grounded if it terminates/originates in any common distribution room (and if required by local, state, or federal building codes).

G. Installation timing:

Cable shall be installed only after the building exterior is complete, the distribution hardware has been completed and stress-tested, and the interior of the building completed to such a point where the risk of damage to the system due to adverse weather conditions has been eliminated.

H. Cable protection:

Any cable installed while building construction is still in progress shall be adequately protected. This includes cables left exposed during the installation process.

Server Technical Specifications Standard

The Commonwealth requires all servers to be no less than Enterprise Level models and not consumer models for the purpose of this Solicitation. For that reason the following minimum standards must be met:

1. Price for all monitors (both CRT and LCD) are required to include a minimum 3 years of depot maintenance with turnaround covering all costs associated with any return. This required Depot warranty is bound by the terms of Section 30.100.
2. All servers submitted by the vendor for initial bid and future addition to the KETS Contract must consist of at a minimum the following specifications:
 - Network - Must be configured with one (1) Fast Ethernet network adapter (10/100BASE-T);
 - Ethernet must operate at a speed of at least 10/100 MBPS verifiable through included software interface;
 - Must demonstrate Simple Network Management Protocol (SNMP) manageability;
 - Must demonstrate visual LEDs to show link integrity and activity;
 - Must have automatic sensing and reconfiguration for the speed of the hub or switch port;
 - Must comply with IEEE 802.3 industry standard 10 MBPS baseband CSMA/CD (10BASE-T) and 100 MBPS baseband CSMA/CD (100BASE-T) standards;
 - Must support Category 5 UTP or better cable installations;
 - Must support Magic Packet Technology to allow server to be remotely woken up;
 - Server must be configured with a minimum, 24X internal, CD-ROM w/ Sound;
 - All hard drives must be at a minimum 10,000 rpm SCSI hard drive;
 - For Windows based servers NOS –server must be manufacturer certified for interoperability with Novell and Microsoft NOS;
 - For Apple based servers NOS –server must be manufacturer certified for interoperability with Apple NOS;
 - Connectivity ports including at the minimum the following:
 - 1 VGA or digital port
 - Keyboard and mouse port
 - 1 serial port
 - External SCSI port
 - Servers and monitors must be Energy Star Compliant.

Server Configurations

Server Specifications				
Tower	Rack Mount Ready	Blade Chassis	Blade Server	Upgrade Options
Processor				
Quad-core 1.6 GHz or the equivalent	Quad-core 1.6 GHz or the equivalent		Quad-core 1.6 GHz or the equivalent	
Memory				
Minimum 4 GB RAM	Minimum 4 GB RAM		Minimum 4 GB RAM	
Cache				
Minimum of 2 MB L2 Cache	Minimum of 2 MB L2 Cache		Minimum of 2 MB L2 Cache	
Integrated Storage				
Minimum 73 GB Mirrored	Minimum 73 GB Mirrored		Minimum 73 GB Mirrored	
Video				
Minimum 16 MB built-in	Minimum 16 MB built-in			
Minimum resolution 1024 x 768	Minimum resolution 1024 x 768			
Hard Drive Controller				
Minimum integrated raid controller	Minimum integrated raid controller			
Power Supplies				
Redundant not required, but recommended	Redundant not required, but recommended			
Hot pluggable not required but recommended	Hot pluggable not required but recommended			
Fans				
Minimum 2	Minimum 2			
Redundant not required, but recommended	Redundant not required, but recommended			
Hot pluggable not required but recommended	Hot pluggable not required but recommended			
Physical Internal Storage				
Minimum 2 drive bays	Minimum 2 drive bays			
Internal DVD-ROM				
8X DVD	8X DVD			

Keyboard				
USB Interface	USB Interface		USB Interface	
Mouse				
USB Interface	USB Interface		USB Interface	
System Bus				
Minimum 3 PCI/PCI X/PCI Express slots	Minimum 2 PCI/PCI X/PCI Express slots (before External SCSI interface or Remote Management Access card)			
Rackmountable				
Capable	Must come rack-mount ready with all rack mount rails, etc, which are specific to server manufacturer.			
External Ports				
Minimum 3 USB port	Minimum 2 USB port			
Minimum 1 VGA port	Minimum 1 VGA ports			

Network				
Configured with one (2) Ethernet network adapter (10/100/1000)	Configured with one (2) Ethernet network adapter (10/100/1000)		Configured with one (2) Ethernet network adapter (10/100/1000)	
Must demonstrate visual property to show link integrity and activity	Must demonstrate visual property to show link integrity and activity		Must demonstrate visual property to show link integrity and activity	
Must have automatic sensing and reconfiguration for the speed of the hub or switch port	Must have automatic sensing and reconfiguration for the speed of the hub or switch port		Must have automatic sensing and reconfiguration for the speed of the hub or switch port	
Must support Category 5e UTP	Must support Category 5e UTP		Must support Category 5e UTP	
Remote Management Access				
Add-on PCI or Built-in	Add-on PCI or Built-in		Add-on PCI or Built-in	
Warranty				
3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	

3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		4 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	
5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required		5 Year ProSupport for IT and NBD On-site Service (8x5 warranty)- no troubleshooting required	
3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		3 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	
4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		4 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	
5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical		5 Year ProSupport for IT 4HR 7x24 Onsite: Non Mission Critical	
3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		4 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)		3 Year ProSupport for IT and NBD On-site Service (8x5 warranty)	

Warranty (continued)				
5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack		5 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack	
3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair	3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair		3 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack:6Hr Repair	
4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack		4 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	
5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack		5 Year ProSupport for IT and Mission Critical 2HR7x24 OnsitePack	

School Construction Technology Guide Template

(used for sections to be completed)

Topic

Classification: New Structure, Renovation, or Addition

Item:

Hardware

Enter Data

Last line

Administrative Items to be considered:

Software

Enter Data

Last line

Types of Projection Displays

Enter Data

Last line

Related Documents: